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THE CONIDIAL STAGE OF PEZIZA PUSTULATA

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(WITH 1 FIGURE)

Heat treatment which is so effective in inducing germination of ascospores of some species has been found indispensable in connection with genetic work with species of *Neurospora, Gelasinospora* and certain other forms. While the method is very effective in growing *Ascobolus carbonarius,* it is of practically no value to induce germination of spores of *Ascobolus magnificus.* It is very desirable that a method be discovered for germinating the spores of this species as well as those of other Ascomycetes where it has been reported that the primary ascus nucleus is tetraploid, while the nuclei of the vegetative hyphae are haploid. If this can be supported genetically it will settle once for all the controversy over double fertilization in the Ascomycetes. *Ascobolus magnificus* varies sufficiently to be adaptable for genetic work if the eight spores of an ascus could be made to germinate.

It is now twenty-five years since the writer published that note on "Artificial cultures of *Ascobolus* and *Aleuria*" (Mycologia **4**: 218–222. 1912). Heat treatment was found to be effective in bringing about germination of the ascospores of the form reported as *Aleuria umbrina.* Fruiting bodies for that work had been found in the first weeks of June of that year on a spot where

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some wood had been previously burned in a shady section of The New York Botanical Garden.

Pure cultures of the fungus on heated soil extract agar always showed a conidial stage of the *Oedocephalum* type but, as was customary in those days, it was not considered "of much importance" and was not mentioned in the note. Taxonomists today, however, are giving more attention to the asexual or conidial stages of the Ascomycetes. It is obvious that every known characteristic morphological feature should be included in formal descriptions. Modern mycologists know that there are many species in which the conidial stage is of as much value in distinguishing genera and species as are the ascocarpic structures themselves. We are accustomed to the thought that the so-called sexual stage is the only important feature, because the ascocarpic structures are all diploid and sporophytic, when as a matter of fact, as it is accepted by every one for *Neurospora*, all of the ascocarpic tissues except the young asci themselves may very well be haploid and therefore "gametophytic." The presence of two or more distinct and haploid nuclei in a cell does not make the cell diploid or polyploid.

I have frequently spoken to Dr. Seaver about "*Aleuria umbrina*," regretting that mention of the conidial stage had not been made at the time. About June 10 of this year he brought to the laboratory a number of fine ascocarps of this species which is now regarded as a synonym of *Peziza pustulata*. He had collected them on a spot where a brush pile had been burned previously. This was not far from where the same species had been found in 1912. It is well illustrated by Seaver, in plate 29, North American Cup-Fungi, 1928. Ascospores from these fruiting bodies were sowed on plates of corn-meal agar and heated at 58° C. for one hour. Practically all of the ascospores germinated (FIG. 1, *i*). On the second day characteristic conidiophores bearing heads of conidia developed from the surface hyphae. The conidiophores (FIG. 1, *a*) are usually about 150–350 μ long, 3 or 4 celled, and end in an *Oedocephalum* head which varies greatly in shape and size—narrow clavate, oval to spherical, 12–20 $\times$ 20–40 μ. Conidiophores may be much longer, sometimes even 1200 μ long with 10 or 15 cells.

The conidia are only very slightly colored and probably would be described as hyaline with a slightly roughened or warted surface, elliptical, 2.5–3 × 6–9 μ (FIG. 1, *b*, *g*). Some are larger, 4 × 12 μ. The point where the conidium was originally attached

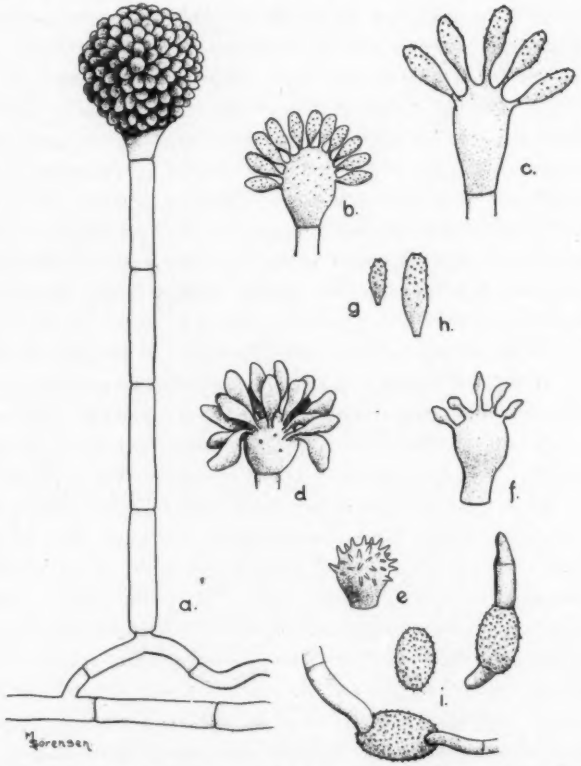


FIG. 1. *a*, conidiophore and *Oedocephalum* head of conidia of *Peziza pustulata* (*Aleuria umbrina*); *b*, similar head with many spores dislodged; *c*, small head of larger type of conidia (there were originally ten conidia on this head, the other five not shown); *d*, a rather abnormal type of conidial head; *e*, head showing sterigmata after conidia of the larger type have been dislodged; *f*, young conidiophore head; *g* and *h*, comparative sizes of the smaller and larger types of conidia; *i*, ascospores two of which are germinating after being given the heat treatment. The smaller types of conidia do not germinate even with the heat treatment and, therefore, according to some persons must be spermatia!

usually shows as a little papilla on the conidiophore head, and as a little knob on the lower end of the conidium.

Brefeld (Unters. Gesammt. Myk. **10**: *pl. 13, fig. 19, 20, 24–26*) shows very similar conidial stages for *Peziza vesiculosa* and *P. cerea*. Although he undoubtedly had the best technique known at that time for culturing fungi, one is not always certain that his cultures were pure, and that forms which he often found associated together belong to the same species. For example, he describes a conidial form of *Sphaerulina intermixta*. One can readily prove that no such stage of this fungus develops in single ascospore cultures. The identity of *Peziza cerea,* according to Seaver, is not very well established. Having proved conclusively, however, that *Peziza pustulata* does have a characteristic conidial stage, there is less objection against assuming that *P. vesiculosa* and *P. cerea* develop somewhat similar conidial stages as described by Brefeld.

One of the sketches made, when the note on *Aleuria* was being prepared in 1912, shows a small head with a few very large conidia attached on rather long thick sterigmata as shown in fig. 1, *c,* which is a copy of the old drawing. There were only ten conidia on this head. On examination of our new cultures we found arising from the surface hyphae rather thick stalks slightly enlarged at the tip-ends. These heads were bearing the same type of large conidia (FIG. 1, *h*). These conidia are also rather distinctly warted, especially at the upper end. The conidiophores may be seven or eight cells in length. The attachment point shows on the conidium as a little socket and the sterigmata that remain on the head are much longer (FIG. 1, *e*). One can tell which heads originally bore the large conidia by the long sterigmata which remain. Occasionally intermediate types develop so that it may be that these differences in size have little significance. Figure 1, *d,* shows a head of a rather abnormal type. As to the functions of the two extreme types of conidia described, we are not ready to say at present. On several occasions we sowed thousands of the small conidia on corn meal agar, on bean agar and on heated soil decoction agar plates. Only one conidium which looked as though it might be germinating was found even after several days in any trial. This was transferred to another plate but it failed

to develop a mycelium. It is strange that the smaller conidia which are developed in such large numbers do not germinate. They are rather too large to be looked upon as spermatia. Since they do not germinate they must be "male," however! Only a few of the large type of conidia were available for germination studies. We succeeded in obtaining a normal mycelium from the only one which germinated. Plates on which both types of conidia were sowed were given the heat treatment without positive results. Plates upon which ascospores had been sowed at the same time showed practically 100 per cent germination after the heat treatment.

In our earlier experiments with this species we obtained solid masses of tissue which may have been the beginnings of ascocarps. The fruiting bodies of this species are of considerable size and one would not expect to obtain full development in petri dish cultures. Nothing is known regarding the sexual nature of the species whether it is heterothallic or not. At least, if one uses the heat treatment to obtain germination, we have a way of obtaining single spore cultures. It remains to find conditions for developing ascocarps under controlled conditions.

THE NEW YORK BOTANICAL GARDEN

NEW VENEZUELAN FUNGI IMPERFECTI

DAVID H. LINDER [1]

(WITH 6 FIGURES)

The specimens described below were communicated to the writer by Professor H. H. Whetzel of Cornell University. They represent odds and ends of interesting Fungi Imperfecti that had not been included in Chardon and Toro's account of the Mycological Exploration of Venezuela, Monographs of the University of Puerto Rico, Ser. B (2): 9–353. *pl. 1–33.* 1934.

The type specimens of the new species described below have been deposited in the Farlow Herbarium, Harvard University, and in the Herbarium of the Department of Plant Pathology, Cornell University. For the privilege of studying and describing these species, the writer wishes to express his thanks to Professor Whetzel.

Cercosporella Hurae Linder & Whetzel, sp. nov. (FIG. *A, B.*)

Maculae usque 7 mm. diametro, orbiculatae vel irregulariter orbiculatae vel confluentae majores, centro "Chamois," [2] margine atro-brunneae vel fere atrae, color in contexto hospitis diffusus; conidiophoris hypophyllis ex stromatibus laete coloratis, pseudoparenchymatis supra stomatibus hospitis oriundis, hyalinis, usque 150 μ longis, 4.5–6 μ diametro, isodiametricis vel sursum versus leniter fastigatis, septatis, non ad septa constrictis, unilateraliter vel alternis ramosis, ramis acute adscendentibus; conidiis acrogenis, hyalinis, cylindraceis, rectis, extremis abrupte rotundatis, (69)–75–100 × 5–6 μ, multiseptatis, septis obscuris.

In foliis *Hurae crepitantis* L., Venezuela.

Spots up to 7 mm. in diameter, round or somewhat irregular, larger and more irregular by confluence, "Chamois" in center, bordered by a dark-brown or almost black margin, the color diffusing into the surrounding host tissue making it appear scorched; conidiophores hypophyllous, arising from a slightly colored pseudoparenchymatous stromatic base formed over the stoma of the host,

[1] Contribution from the Laboratories of Cryptogamic Botany and the Farlow Herbarium, Harvard University, No. 152.

[2] Ridgeway, R. Color Standards and Color Nomenclature, Washington, D. C., 1913, is cited when color names are given in quotation marks.

hyaline, up to 150 μ long, 4.5–6 μ in diameter at the base, slightly tapering upwards or isodiametric, septate, not constricted at the septa, unilaterally or alternately sympodially branched, the branches sharply ascending; conidia acrogenous, hyaline, many septate, the septa indistinct, cylindrical, straight, abruptly rounded at the ends, (69)–75–100 $\times$ 5–6 μ.

On leaves of *Hura crepitans* L., east shore of Valencia Lake, 420 m. elev., Aragua, Venezuela, June 28, 1932, C. E. Chardon, Mycological Survey of Venezuela, *363*.

Of the species of *Cercosporella* that have been reported as occurring on Euphorbiaceous hosts, *C. Crotonis*, P. Henn. and *C. peronosporoides* Speg. appear from the descriptions to resemble this one most closely. However, *C. Crotonis* produces conidiophores which are said to measure 40–80 $\times$ 5 μ, and conidia that are 20–40 $\times$ 3.5–5 μ, while *C. peronosporoides* forms conidiophores that are 10–25 $\times$ 5–6 μ and conidia that are 10–60 $\times$ 5–7 μ.

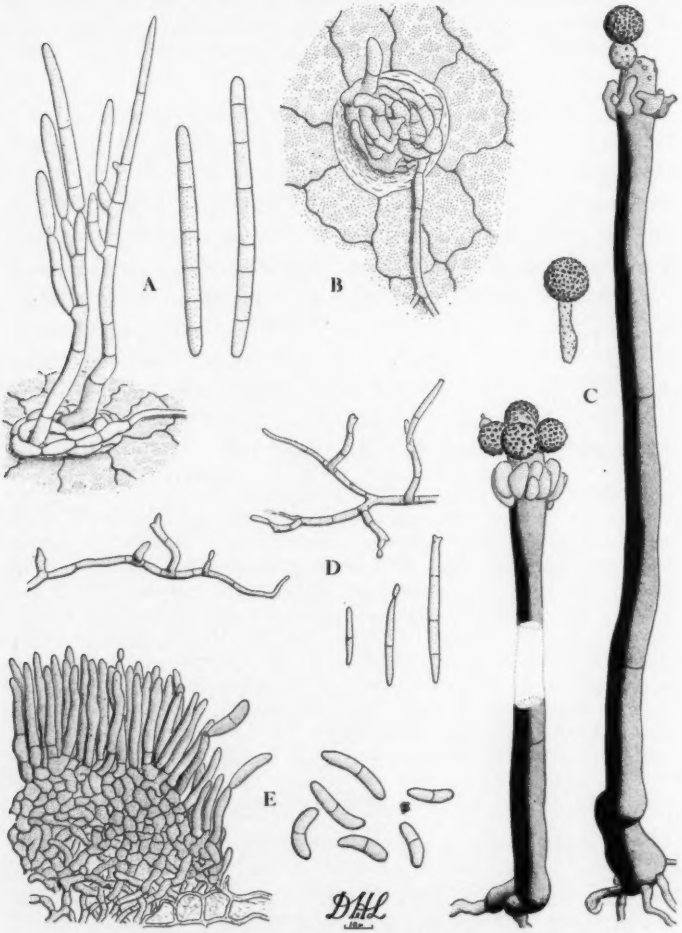
Periconia Toroi Linder, sp. nov. (FIG. C.)

Maculae irregulares, usque 10 mm. diametro, cinereae, translucentes, margine atro-brunneae; myceliis sterilibus gracilis, ramosis, septatis, intramatricis; conidiophoris simplicibus, atro-fuscis vel fere atris, ad apicem subfuscis, 1–3-septatis, usque 330 μ longis, infra 12–13.5 μ, supra 10.5–12.5 μ diametro, ad basem nonnihil abrupte bulbose inflatis, cellula terminali sub apice verticillo unico cellularum sporogenarum primariarum cincta; cellulis sporogenis primariis irregulariter ellipsoideis vel elongato-ellipsoideis, simplicibus vel furcatis, inconspicuiter et sparse verruculosis, brunneis, non caducis, 9–15 $\times$ 6–7.5 μ; cellulis sporogenis secondariis sessilibus, caducis, ad regionem apicalem dilute coloratem conidiophoris vel ad cellulas sporogenas primarias gestis, ovoideis, elongato-ellipsoideis vel irregulariter clavulatis, dilute coloratis, sparse verruculosis, 9–15 $\times$ 5–7.5 μ; conidiis globosis, 15–16.5–(20) μ diametro, conspicuiter et dense verrucosis, brunneis.

In foliis *Machaerii Moritziani* Benth., Venezuela.

Spots irregular, up to 10 mm. in diameter, cinereous, translucent, bordered by dark-brown margins: sterile mycelium slender, branched, septate, intramatrical: conidiophores simple, dark-brown to almost black, somewhat lighter colored near the apex and above the primary sporogenous cells, 1–3-septate, up to 330 μ long, 12–13.5 μ in diameter near the base, 10.5–12.5 μ above, the base often abruptly inflated into a bulbous swelling, the apical cell somewhat clavate-inflated; the primary sporogenous cells forming a whorl below the apex of the conidiophore, simple or branched, inconspicuously verruculose, not deciduous, 9–15 $\times$ 6–7.5 μ; the secon-

dary sporogenous cells produced on the primary sporogenous cells or sessile on the apical region of the conidiophore above the



FIGS. *A, B, Cercosporella Hurae; C, Periconia Toroi; D, Ramularia Malvastri; E, Pucciniopsis Lonchocarpi.*

whorl of primary sporogenous cells, light colored, sparsely and inconspicuously verruculose, irregular in shape, ovoid, elongate ellipsoid, or irregularly clavulate: conidia deeply colored, con-

spicuously and densely verrucose, globose, 15–16.5–(20) μ in diameter, in chains.

On leaves of *Machaerium Moritzianum* Benth., Hills Petare, Santa Lucia road, 1200–1250 m. elev., Miranda, Venezuela, July 8, 1932, Chardon & Toro, Mycological Survey of Venezuela, *440*.

The writer takes great pleasure in dedicating this species to Professor Raphael A. Toro of the University of Puerto Rico in recognition of his interest in tropical fungi and of his enthusiasm as a collector.

This species is very similar to *P. pycnospora* Fres. and to *Pachytrichum Guazumae* Syd. (Ann. Myc. **23**: 421–422. *fig. 14.* 1925) but from these two it may readily be separated by the fact that the terminal cell is much longer than wide and is slightly clavate inflated, whereas in the other two species the terminal cell is but slightly longer than wide, and is somewhat bulbous inflated. Although Sydow (*l.c.*) states that the conidiophores arise from a stromatic base, the morphology of the fruiting structure is such that it cannot well be distinguished from that of the genus *Periconia.* Therefore it is proposed here to make the new combination **Periconia Guazumae** (Syd.) Linder.

In order to bring out the differences between *P. Toroi* and other rough globose spored species of the genus, the following key has been constructed, for the most part based on the literature, but where possible amplified by a comparison of species in the von Hoehnel collection.

1. Spores less than 10 μ in diameter.....2.
1. Spores 10 μ or more in diameter.....4.
2. Spores 2 μ diam.; conidiophores 100 × 2.5 μ, rarely septate, densely gregarious.....*P. Langloisii* Earle.
2. Spores 5–8 μ diam., minutely echinulate or roughened.....3.
3. Conidiophores 150–300 × 14 μ (base), simple.....*P. Commonsii* Earle. *P. byssoides* Pers.*
3. Conidiophores up to 500 μ in length, often somewhat branched at the apex; spores 6–8 μ diam., minutely roughened.....*P. nigriceps* Peck.
4. Spores minutely echinulate or muriculate.....5.
4. Spores verrucose or verruculose.....6.

* According to Earle (N. Y. Bot. Gard. Bull. **2**: 332. 1902.) this is the same as *P. pycnospora* Fres. although Lindau (Rabenhorst, Krypt. Fl. 1^8: 613. 1906) states that the spores of *P. byssoides* are 5–7 μ diam., whereas those of *P. pycnospora* are 12–17 μ in diameter.

5. Spores 10–14 μ diam.; conidiophores 400–500 × 14 μ, 2–4-septate *P. epiphylla* (Sw.) Earle.
5. Spores 16–18 μ diam., spines 0.5 μ long; conidiophores 200–300 μ long, septate, curved-circinate above..... *P. circinata* (Mang.) Sacc.
6. Conidiophores 800–900 × 17 μ, 2–3-septate; spores 13 μ diam. *P. Coffeae* Zimm.
6. Conidiophores shorter.....7.
7. Conidiophores 18 μ diam. at base, 150–300 μ long, 1–2-septate (obscurely); spores 16–18 μ diam..... *P. Palmeri* Earle.
7. Conidiophores of lesser diameter, or if as large then the spores are smaller (see *P. Citharexyli*).....8.
8. Conidiophores 15–20 μ diam., 120–300 μ long; conidia 10–14 μ diam., granulose-verrucose..... *P. Citharexyli* Henn.
8. Conidiophores 10–16–(18) μ diam., 100–400 μ long.....9.
9. Apical cell of conidiophore much longer than wide, the conidiophore up to 350 μ long, 12–13.5 μ diam. near base, 1–3 septate; spores 15–16.5–(20) μ diam., coarsely verrucose..... *P. Toroi* Linder.
9. Apical cell only slightly longer than wide, somewhat bulbous inflated..10.
10. Conidiophores solitary or scattered, not arising from a stromatic base, 200–300 × 10–14–(18) μ, 1-several-septate; conidia 12–17 μ diam., finely verruculose..... *P. pycnosporous* Fres.
10. Conidiophores aggregated, arising from a stromatic base, 120–250 × 10–16 μ, 1–3-septate; spores 7–18 μ diam., verruculose *P. Guazumae* (Syd.) Linder.

Pucciniopsis Lonchocarpi Linder, sp. nov. (FIG. *E*.)

Maculae parvae, plerumque 1 mm. diametro minores, vel confluentes majores, supro ochraceo-cinereae, infra brunneae vel atro-brunneae; conidiophoris ex stromatibus pseudoparenchymatis, dilute fuscis, 20–60 μ crassis, 150–200 μ diametro vel confluendis amplioribus oriundis, fuscis vel ad apices dilute fuscis, minute et inconspicuiter verruculosis, 0–1-septatis, usque 30 ×4.5 μ, leniter ad apices rotundatis truncatisque fastigatis; conidiis 1-septatis, curvatis, nonnihil undulatis vel raro rectis, minute verruculosis, subhyalinis vel dilute fuscis, 18–30 × 5–6 μ, leniter ad basim truncatum et ad apicem abrupte vel acute rotundatum fastigatis.

In foliis *Lonchocarpi* sp., Venezuela.

Spots small, usually less than 1 mm. in diameter, but may be larger by confluence, yellowish or ochraceous cinerous above, dark-brown below: conidiophores hypogenous, arising on a colored pseudoparenchymatous stromatic base, up to 20–60 μ thick and up to 150 or 200 μ wide, wider by confluence: conidiophores densely aggregated into a hymenium-like layer, more deeply colored than the stromatic tissue, very minutely verruculose, 0–1-septate, up to 30 × 4.5 μ, slightly tapering to a rounded, truncate apex: conidia 1-septate, curved, undulate or rarely straight, minutely verruculose, subhyaline to dilute fuscous, 18–30 × 5–6 μ, slightly

tapering towards the truncate base and towards the abruptly or acutely rounded apex.

On *Lonchocarpus* sp., Hills Petare, Santa Lucia road, 1200–1250 m. elev., Miranda, Venezuela, July 8, 1932, Chardon & Toro, Mycological Survey of Venezuela, *432*.

The morphology and dimensions of the conidiophores and conidia segregate this species from those previously described. *Pucciniopsis Caricae* (Speg.) Earle produces conidiophores that measure 40–50 × 7–8 μ and are non-septate, and conidia that are 18–20 × 8–10 μ; *P. Anacardii* Sydow produces 1–3 celled conidiophores that are 12–25 × 4–6 μ, and conidia that are 22–35 × 9–12 μ; *P. caffra* Wakefield produces non-septate conidiophores, 10–15 × 4–5 μ, which bear conidia 18–20–(24) × 8–10 μ; and *P. quercina* Wakefield produces 4–5-septate conidiophores that are simple or short-furcate apically and 7–8–(9) μ in diameter, while the conidia are 18–22.5 × 12–14 μ.

Ramularia Malvastri Linder, sp. nov. (FIG. *D*.)

Maculae indistinctae, supra "Tawny," infra "Cream Color" vel "Cream Buff," usque 5 mm. diametro, orbiculatis vel angulatis, interdum confluentes; myceliis sterilibus externis in superficie inferiore foliae hospitis vel intra hospitem, hyalinis, septatis, ramosis, 0.75–1.5 μ diametro; conidiophoris brevibus, rectis vel adscendentibus ex hyphis sterilibus oriundis, 1.5–3 μ diametro, 1–3-septatis, levibus, hyalinis vel laete coloratis, pauce ad apicem denticulatis vel leniter geniculatis; conidiis catenulatis, catenulis facile fractis, 1–3-septatis, levibus, hyalinis vel dilutissime coloratis, cylindraceis, 16.5–36–45 × 2–3 μ, leniter ad basim truncatum et ad apicem acute vel obtuse rotundatum fastigatis.

In foliis *Malvastri* sp., Venezuela.

Spots indistinct and "Tawny" above, "Cream Color" or "Cream Buff" below, up to 5 mm. in diameter, rounded or angular, occasionally coalescing. Sterile mycelium superficial or within the host, hyaline, septate, branched, 0.75–1.5 μ in diameter; conidiophores as short erect or ascending branches from the sterile mycelium, 1.5–3 μ in diameter, 1–3-septate, even, hyaline to slightly colored, few denticulate (1–5) or slightly geniculate at the apex of the terminal cell; conidia catenulate, the chains readily breaking apart, 1–3-septate, even, hyaline to very dilutely colored, cylindrical, slightly tapered to the truncate base and the obtusely or acutely rounded base, 16.5–36–45 × 2–3 μ.

On *Malvastrum* sp., ravine at Adjuntas, south of Trompillo, 600 m. elev., Carabobo, Aug. 3, 1892, Chardon & Toro, Mycological Survey of Venezuela, *774*.

This species appears to be distinct from other members of the genus that occur on malvaceous hosts. The predominantly external sterile mycelium, the morphology of the conidia and conidiophores set this species apart. It is somewhat difficult to obtain an accurate idea of the length of the spores of this species since they tend to elongate considerably as they germinate *in situ*, giving rise directly either to mycelium or else secondary conidia which are borne on denticles at the end of the primary conidia. However, the measurements given above are the average of those spores which have come free in the mounting medium (lactophenol).

Stigmella graminicola Linder, sp. nov. (FIG. *F*, 1–11.)

Coloniis atris, superficialibus, compactis, pulverulentis, Ustilaginacearum simulantibus: myceliis sterilibus hyalinis vel subhyalinis, repentibus, ramosissimis et tegetem densam formantibus: conidiophoris forma ramarum brevium, rectarum vel adscendentium, ab myceliis sterilibus orientibus, hyalinis vel subhyalinis, laevibus, breve ramosis: conidiis dense congestis, 14.4–18 × 12.5–16.5 μ, atro-fuscis, ovoideis vel ellipsoideis, ad apicem abrupte rotundatis vel saepe lobatis, ad basim truncatis, saepissime septis horizontalibus 1 raro 3 divisis, cellula basalari verticaliter 0–1–(2–) septata (raro cellula apicali non septata et cellula basilari verticaliter 1–3-septata), ad septa constrictis et parietibus minute et dense verruculosis.

Hab. in paniculis *Tricholaenae roseae* Lk. (?), prope Caracas, Venezuela.

Colonies superficial, compact, pulverulent, black and resembling a smut in gross appearance. Sterile mycelium hyaline or subhyaline, repent, much branched and forming a dense mat in the older portions. The conidiophores are hyaline to subhyaline, smooth, arising as short erect or ascending branches which in turn branch. The conidia measure 14.4–18 × 12.5–16.5 μ, dark brown to nearly black and opaque, ovoid to ellipsoid and bluntly rounded or somewhat lobed at the apex, truncate at the base, irregularly septate, mostly 1-septate or occasionally 2-septate horizontally; the apical cell vertically 1–3-septate and the basal cell vertically 1–2-septate (less frequently the apical cell is non-septate and the basal or median cell is vertically 1–3-septate), the cells constricted at the septa, and the cell walls are minutely and closely finely warted.

In the panicles on the inflorescence and grain of *Tricholaena roseae* Lk. (?) near Caracas, Dist. Federal, Venezuela, Chardon & Toro, Mycological Exploration of Venezuela, *394*.

This hyphomycetous fungus, which so closely resembles a smut, appears to be distinct from any species of the genus that have been described as growing on hosts belonging to the Gramineae. Because the spores do not aggregate or coalesce to produce large irregular multiseptate asexual fruiting structures, and because a

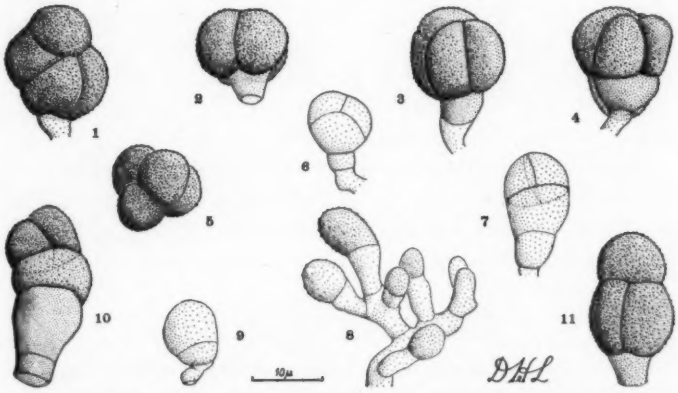


FIG. *F*. All figures drawn with the aid of a camera lucida at a magnification of 2350 × before reduction. 1–5, mature conidia of *Stigmella graminicola* to show the common variations in the method of septation, those figured in 3 and 4 being the more typical; 5 represents the top view of a conidium; approximately × 1175. 6–9, immature conidia and a portion of the fertile hyphae, the latter drawn as seen from above. The conidia are at first smooth and hyaline but soon, and as the spores become repeatedly divided by septations, become deeply colored and minutely though closely warted; approximately × 1175. 10–11, mature conidia showing abnormal septation and size; approximately × 1175.

definite though short conidiophore is present, it would appear that this form should be placed in the genus *Stigmella* rather than in the more or less nondescript genus *Coniothecium*. Among the species of the genus *Stigmella*, *S. Sacchari* Spegazzini (Rev. Facult. Agron. Vet La Plata **2** (19) : 252–253. 1896) approaches this species most closely, but according to his description, the spores are divided at first by three horizontal septa to form a four-

celled structure, the middle cells of which are again divided by longitudinal septa. The conidia of the species at hand are divided by one, less frequently two, and rarely three horizontal septa. Most commonly only the terminal cell is divided by longitudinal septa (FIG. *F*, 2–4). However, the number and direction of the septa is somewhat variable (FIG. *F*, 1, 10, 11). The conidia of *S. Sacchari* are somewhat longer and proportionately narrower than are those of *S. graminicola* since, according to Spegazzini, they measure 20–30 × 10–15 μ. The two species also differ in habitat for *S. Sacchari* Speg. grows on the leaves, sheaths, and culms, and causes but little or no damage to the host, whereas *S. graminicola* is confined to the florets through which the mycelium ramifies sufficiently to suppress the formation of grain. Indeed, it is possible that the developing caryopsis is first infected and that the fungus later spreads into the sterile floral parts. At all events, the differences in the morphology and biology of the two species is quite sufficient to warrant their separation and the recognition of *Stigmella graminicola* as a new species.

EXPLANATION OF FIGURES

All drawings have been made with the aid of a camera lucida from material mounted in lactophenol. The figures as reproduced are represented at a magnification of approximately × 500.

Fig. A–B. *Cercosporella Hurae* Linder & Whetzel. **A**, two spores and the conidiophores arising from a loosely organized stromatic base illustrate well the characteristics of this species; **B**, a less mature stromatic base is shown giving rise above to a conidiophore, and below, to a stolon-like hypha that grows out over the surface of the host. **Fig. C.** *Periconia Toroi* Linder. The conidiophore shown in full length, and the foreshortened one, illustrate well the secondary conidiophores which are arranged in a whorl below the apex of the main axis, and above the whorl are shown, either directly arising from the primary conidiophore or from the caducous secondary conidiophores, the spores which are often found in chains. **Fig. D.** *Ramularia Malvastri* Linder. Typical conidiophores of irregular shape and length are shown arising from the repent, superficial vegetative hyphae. Below are conidia showing the variation in shape and size of the conidia, and the method of germinating by producing secondary smaller spores. **Fig. E.** *Pucciniopsis Lonchocarpi* Linder. The numerous simple conidiophores are shown arising from the lighter colored stromatic base. At the right are shown a few of the colored, verruculose, uniseptate conidia.

A NEW FUNGUS INTERMEDIATE BETWEEN THE RUSTS AND SEPTOBASIDIUM

JOHN N. COUCH

(WITH 30 FIGURES)

While collecting *Septobasidium* in South Carolina a minute fungus was found which seems to combine to a remarkable degree some of the characters of the rusts and of *Septobasidium*. In its spore forms this fungus strikingly resembles certain rusts, while in its parasitism on scale insects it resembles *Septobasidium*. Since this fungus can be put neither in *Septobasidium* nor in any known genus of the rusts, it seems necessary to erect a new genus somewhat intermediate between these two groups.

Uredinella gen. nov.

Teleutosporae uninucleatae, cylindricae vel pyriformes, brunneae. Binucleatae sporae similes teleutosporis etiam formatae, quae non basidias sed binucleatas longe ellipticas parce curvas sporas generant.

Hab. supra Coccidas in quibus haustorio simili haustorio *Septobasidii parasitantur.*

Mature teleutospores uninucleate, cylindrical to pyriform with a distinct germ pore, brownish, giving rise to a typical, four-celled, septate basidium. Binucleate teleutospore-like structures also formed which give rise not to basidia but to binucleate, long-elliptic, slightly bent spores. Growing on scale insects which are parasitized by haustoria of the *Septobasidium* type.

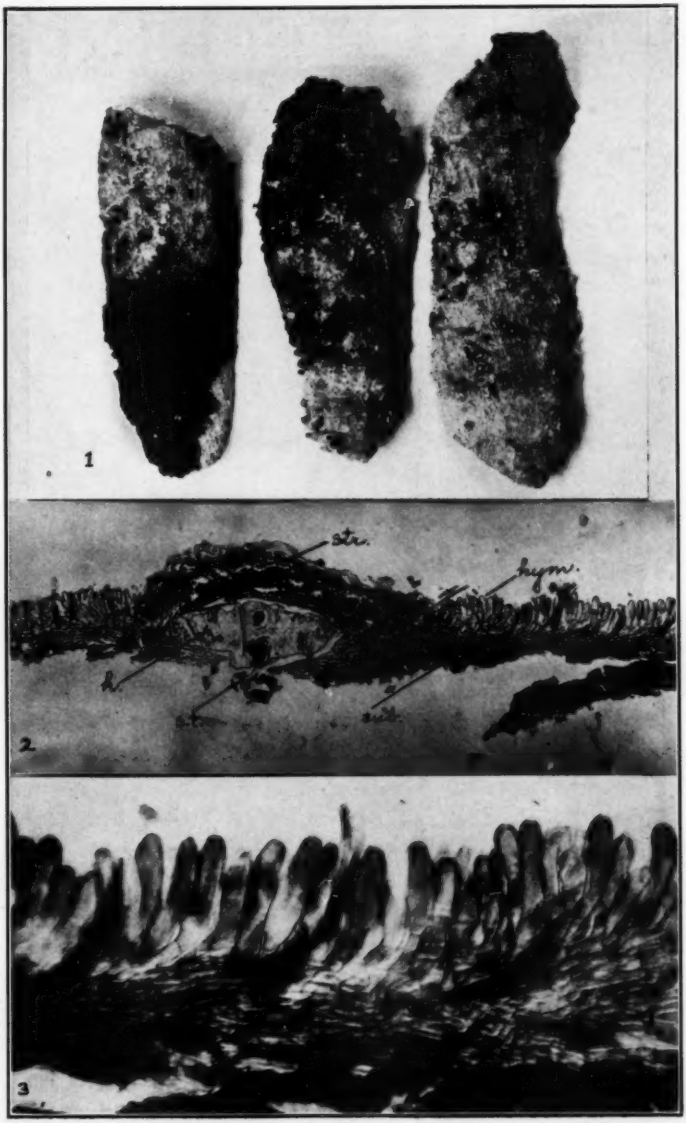
Uredinella coccidiophaga sp. nov.

Maculae minutae, 0.2–1.5 mm. diam., orbiculatae, effusae, annuae ad corticem arborum frondosarum, facile separabiles; colore valde castaneo vel brunneo; contextu firmo, sicco, 100–300 μ crasso. Teleutosporae 10–17 $\times$ 30–50 μ, germinantes apice forameni distincto et formantes cylindricum, 3-septatum basidium, 7.5–8.4 $\times$ 48–54 μ; sterigmata 7 μ; sporae curvae, ellipticae, 4.2–5.4 $\times$ 16.8–21.8 μ. Binucleatae sporae similes teleutosporis etiam formatae, quae binucleatas longe ellipticas parce curvas sporas generant.

Hab. supra Coccidas. Haustoria inaequaliter tortuose convoluta.

Forming minute, circular, flattened, discoid patches 0.2–1.5 mm. wide, on the bark of several deciduous trees, easily separable from the substratum, annual, always overgrowing a scale insect. Color very dark-chestnut to mummy-brown (Ridgway). Texture firm, dry, somewhat brittle. Surface smooth and velvety, or sometimes with bumps and radial ridges. Margin sharply determinate, frequently lighter colored than the main part of the fungus. In section 100–300 μ thick, consisting of compactly arranged basal hyphae extending radially and appearing pseudoparenchymatous in transverse section; hyphae hyaline to dark brown, septate, without clamps. Teleutospores arising from these hyphae and forming a compact hymenial layer with a few sterile hyphae intermingled. The older teleutospores near the center, though none formed directly over the scale insect, the younger ones near the margin. Teleutospores 10–17 $\times$ 30–50 μ, ovoid to club-shaped or cylindric, most commonly thickest at the distal end. Teleutospore-wall composed of two layers, a thin outer layer hyaline in the basal part but brownish and thicker toward the top, smooth or warted toward the apex, and a thicker, inner, brownish layer. In some spores there appears to be a third layer, a thin, inner hyaline membrane. In the spore membranes there is a distinct apical germ-pore. Young teleutospores binucleate, becoming uninucleate early, before the wall is thickened, germinating in the spring when moist to form a cylindric, 4-celled basidium, 7.5–8.4 $\times$ 48–54 μ; sterigmata typically arising from each cell, usually about 7 μ long. Spores bent-elliptic, 4.2–5.4 $\times$ 16.8–21.8 μ A small amount of cytoplasm with a small nucleus remaining in each sterigma after spore-formation. Spores germinating in water by the formation of another sterigma and a secondary spore. Spores of another type in addition to the typical uninucleate teleutospore,

FIG. 1. Small dark patches of *Uredinella coccidiophaga*. *S. castaneum* Burt on lower half of piece to left. Natural size. 2, vertical section through part of a patch of fungal growth showing scale insect which was in center of patch. Note haustoria (h) in insect and sucking tube (st) of latter. Fungus penetrates insect in oral region and just above the sucking tube several pieces of penetrating hyphae are visible. Note also stromatic, sterile tissue (str) over insect; hymenium (hym.) and subiculum (sub.). $\times$ 107. 3, enlarged view showing subiculum and hymenium. Note germ pores in teleutospores. $\times$ 486.



FIGS. 1–3.

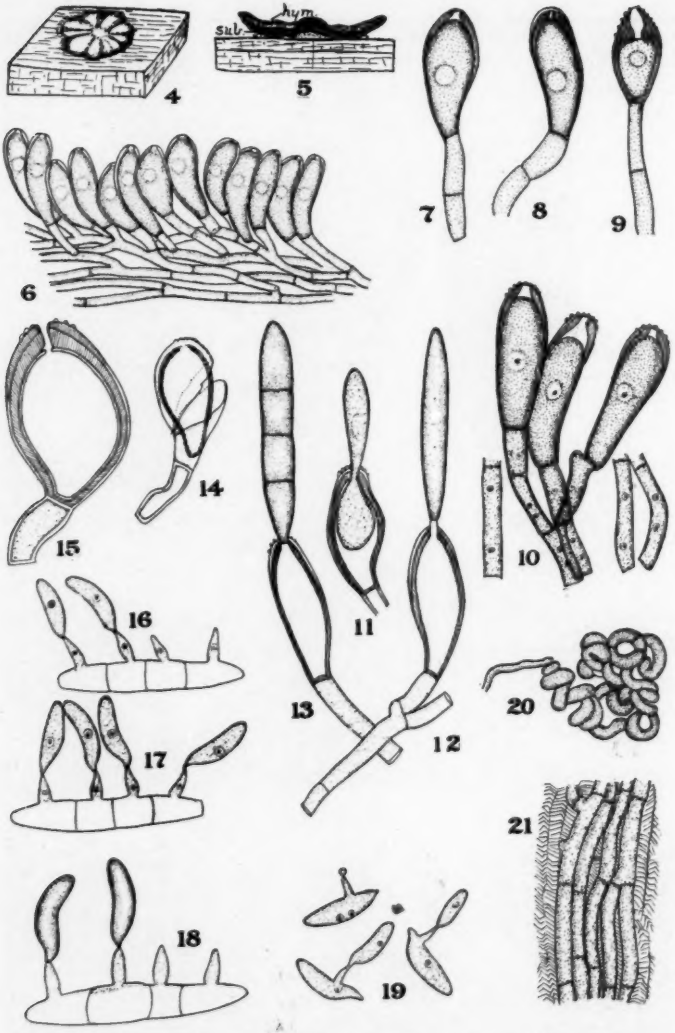


FIG. 4, surface sketch of fungus showing ridges, × about 4.5; 5, diagrammatic section through entire fungus showing insect in center with its sucking tube; subiculum and hymenium, × about 4.5; 6, section through hymenium showing teleutospores, × 302; 7–9, teleutospores, × 472; 10, teleutospore and mycelium cells, nuclei stained with coton blue in Amann's lactophenol, × 522; 11–13, germination of teleutospores to form basidia, × 472; 14,

intermingled with the teleutospores and externally resembling them, are more uniformly cylindric and binucleate; and give rise to a binucleate, long-elliptic, slightly bent spore. At the end of the spore-producing season (perhaps early summer) the fungus dies and dries up.

Associated with scale insects, one parasitized insect being beneath each patch of fungal growth. Haustoria of the irregular coiled type with sausage-shaped cells here and there. The connection between the haustoria and the external fungus is made around the insects' mouth.

Specimens examined: South Carolina: Near Charleston; on bark of *Quercus phellos*, parasitizing *Aspidiotus* sp., with *Septobasidium castaneum*, *S. pseudopedicellatum* and *S. sinuosum*, and *Myriangium* sp.; March 19, 1930, J. N. Couch, coll., No. *8468*. Near Myrtle Beach, about 4 miles south on left side of beach road; abundant on *Ilex americana*, parasitizing *Aspidiotus* sp., with *Septobasidium castaneum*, and *Myriangium* sp.; April 25, 1937, J. N. Couch, coll., No. *10426* (type) in U. N. C. Herb.

NOTES ON CYTOLOGY

Because of the minute size of the fungus and its striking superficial resemblance to *Myriangium* sp., it could easily be overlooked or taken for the latter. In fact in the first lot of material collected, the fungus was not observed in the field but was accidentally discovered several months after it was collected when I was studying the margin of *S. castaneum* under the binocular dissecting microscope. By this time the peculiar bodies which I took to be teleutospores had so thoroughly dried that, though soaked over night in water, they failed to germinate. Having once carefully observed the fungus, it was possible to recognize it and to

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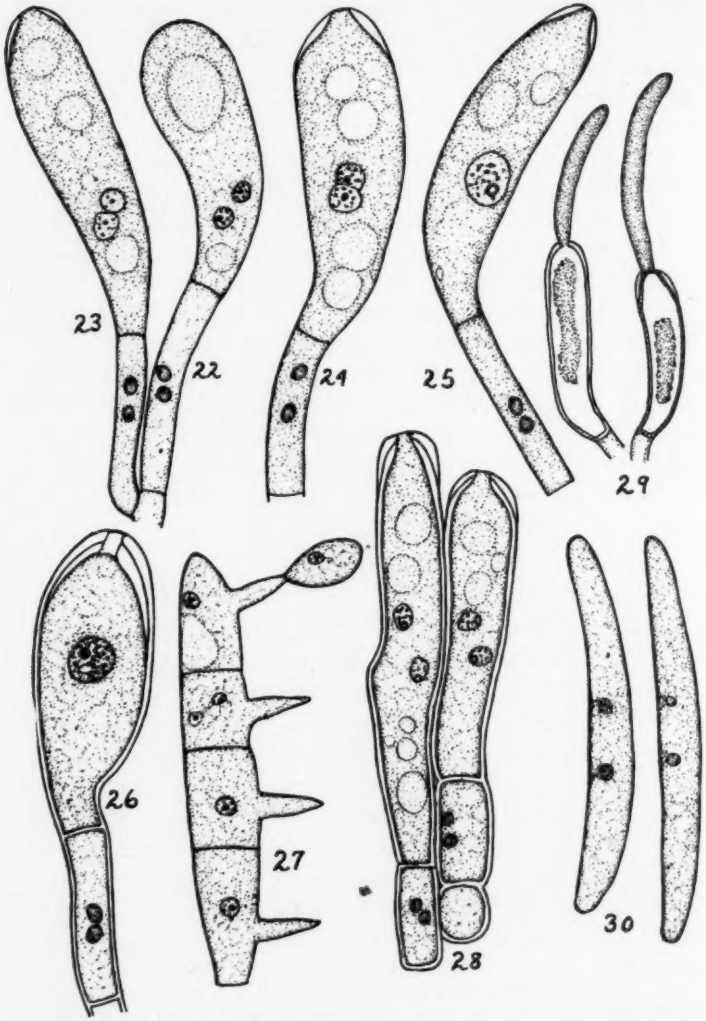
empty teleutospore the outer membrane of which has been cracked, showing distinctly the inner, dark colored, thicker wall, × 472; 15, section of empty teleutospore showing three apparent membranes, × 837; 16–19, basidia and spores (note one nucleus in each spore except 19a and one in each sterigma in 16 and 17), 16, 17, and 19 drawn from material mounted in Amann's lactophenol and coton blue; 18 drawn from material still floating on water, × 472; 20, coiled haustorium from within body of parasitized insect, × 522; 21, fungal threads growing over external body wall of insect, × 522.



FIGS. 22–26, stages in nuclear fusion in the young teleutospore and thickening of wall and formation of germ pore (note nuclear fusion is completed before wall has become thick, × 1221); 22–25, 27, and 30 from preparations stained by Gram's method; 26 and 28 iron alum haematoxylin staining; 27, basidium (note late nuclear division in one cell); in the apical cell note one nucleus in spore and one remaining in cell; sterigmata formed but nuclear

distinguish it from *Myriangium* even with the unaided eye. Though similar in size, the present fungus is brownish instead of black and has a flatter habit of growth than has *Myriangium*.

In April 1937 another trip was made to South Carolina to collect this fungus in the fresh condition in the hope that the peculiar teleutospores might be induced to germinate. Abundant material was found near Myrtle Beach, S. C., and was kept moist. Upon returning to Chapel Hill, the pieces of bark on which the fungus was growing were soaked in water for about thirty minutes and then put in damp chambers. An examination of several of the pieces after about 48 hours showed that some of the teleutospores had germinated to form a four-celled basidium. Maximum germination was obtained only when the material was kept well soaked. Indeed the largest number of basidia were obtained on pieces of material mounted in water under a cover slip. Such basidia, however, became septate as usual but failed to produce sterigmata and spores. After the basidium has reached its mature size and before the sterigmata are formed it usually falls away from the teleutospore, in nature perhaps usually adhering to the surface of the fungus.

If such basidia are floated on a drop of water, practically every one will produce sterigmata and spores, while the ones which sink to the bottom of the drop enlarge considerably but fail to germinate.

Due to the fact that the basidia break off from the teleutospores so easily, it was impossible to fix, section, and stain material showing the attached basidia. Also the mature teleutospore wall is very brittle and difficult to section. Gram's stain was good on the young teleutospores but poor on the mature ones. Iron alum haematoxylin showed good nuclei in all but division stages. Material which contained teleutospores with attached basidia mounted in Amann's lacto-phenol with coton blue as a stain, showed the essential cytological features, but rather poorly. One very good slide with many basidia and spores was prepared by killing with

division has not yet occurred in two basal cells, × 1221; 28, two uredospore mother cells each with thick brownish wall and two nuclei, × 1221; 29, uredospore mother cells germinating to form uredospores, × 827; 30, binucleate uredospores, × 1221.

osmic acid fumes and staining with gentian violet (Gram technique). This showed the nuclei in the basidia and spores. No very clear division stages were seen. The cells of the mycelium are binucleate, as are also the young teleutospores. Nuclear fusion occurs in the young teleutospores while the walls are still thin, so that by the time the teleutospore is mature it is invariably uninucleate.

When the teleutospore germinates, the single large nucleus passes out with the protoplasm to form the basidium. Two nuclear divisions then follow in both of which the spindles appear to be longitudinal. Three transverse walls are formed cutting the basidium into four uninucleate cells. From each cell a sterigma now sprouts and when the sterigma has about reached its mature length, the nuclei each divide again so that each cell is binucleate. When the spore is formed, one nucleus passes into it; the other, with a little cytoplasm, remains in the sterigma. In this connection it is of interest to recall the behavior of the sterigmata of *Septobasidium Curtisii* (Berk. & Des.) Boed. & Stein. (Couch, Journ. E. M. Sci. Soc. **49**: 156. 1933). Here the sterigmata remained full of protoplasm after the spores had been discharged and if kept moist gave rise to several, minute, ovoid bud cells. The sterigmata in *S. Curtisii* also undoubtedly contained nuclei as in the present species. If the spores are kept moist, each one forms a sterigma, the nucleus divides and one passes out with the cytoplasm into a secondary spore, while the other remains behind with some cytoplasm in the sterigma.

In addition to the teleutospore another kind of spore is formed. This spore is cylindrical as are some of the teleutospores and appears to be identical with the latter in wall structure. They differ from the teleutospores in being binucleate and in giving rise not to a basidium but to a non-septate, binucleate, long, bent-elliptic spore. These spores were fairly abundant and were found in all stages of formation from the thick-walled, teleutospore-like structures, and hence we can feel certain that these spores belong to the present fungus. Since they are binucleate and arise from the teleutospore mycelium they might be regarded as a peculiar type of uredospore. All efforts to induce the germination of these spores failed. The teleutospore-like structure which gives rise to

these peculiar uredospores might then be called the uredospore mother cell. So far as I have been able to find no spores like these have been described in any of the rusts.

SUMMARY

A new genus and species of fungus, *Uredinella coccidiophaga,* intermediate between the rusts and *Septobasidium* is described. The fungus produces a small, discoid, compact, annual growth which covers and is nourished by one scale insect, forming within the insect's body haustoria of the *Septobasidium* type. After producing spores in the spring, the fungus dies. Brown, thick-walled teleutospores are formed which in nuclear behavior, and external structure strikingly resemble the teleutospores of certain rusts. The basidia are four-celled and each cell is uninucleate at first. Before the spores are formed, nuclear division occurs in each cell. One nucleus goes into each spore and one remains with some cytoplasm in each sterigma. In water, the spores each produce a sterigma and another spore, the nuclear behavior in the basidial cells being repeated. In addition to the teleutospore, another type of spore is formed. This resembles the teleutospore in color and wall structure and resembles some of the teleutospores in being cylindrical in shape. It differs from the teleutospores in being binucleate and in producing a long, bent-elliptic, binucleate spore. The latter is regarded as a uredospore and the spore that bears it as a uredospore mother cell.

DEPARTMENT OF BOTANY,
UNIVERSITY OF NORTH CAROLINA,
CHAPEL HILL, N. C.

A NEW SPECIES OF CORDYCEPS WITH NOTES CONCERNING OTHER SPECIES [1]

E. B. MAINS

(WITH 2 FIGURES)

In 1931, in Nova Scotia, L. E. Wehmeyer obtained two specimens of a *Cordyceps* which was unique in several respects. In 1934, A. H. Smith collected a number of specimens of the same fungus in the Adirondack region of New York. During the summer of 1936 the writer obtained one specimen in the El Cayo District of British Honduras and Dr. Smith obtained a specimen in Ontario.

This species is characterized by a limited cushion of fertile tissue which develops from a point on one side of the clava a short distance below the apex and partly surrounding the clava (FIG. 1, 2). This usually brings about an oblique development of the upper portion of the clava. *Cordyceps unilateralis* (Tul.) Sacc. occurring on ants in the tropics has a somewhat similar habit. It differs decidedly in color being described as blackish-brown. Also Petch (**6**) states that *C. unilateralis* is an *Ophiocordyceps* having fusoid ascospores 90 μ long which do not break up into segments. The species under discussion is a true *Cordyceps* having filiform ascospores approximately as long as the ascus (330 μ), the spores breaking up into segments. It apparently is an undescribed species for which the following name is proposed.

Cordyceps viperina sp. nov. (FIG. 1, 2).

Clavis singularibus, filiformibus, 5–15 mm. longis, 0.5 mm. crassis, aurantiis, acuminatis; peritheciis immersis in pulvinis, ovoideis, 330–440 $\times$ 230–275 μ, brevibus ostiolis; pulvinis 1.5–2.5 mm. latis, lateralibus sub apicibus; ascis cylindricis, 330 $\times$ 8–10 μ; ascosporis 8, filiformibus, in articulos 6–8 $\times$ 2 μ mox fragmentibus.

Ex larvis scarabaeorum. Specimen typicum in Herb. Univ. Mich. conservatum A. H. Smith n. 387, Catlin Lake, N. Y., Aug. 1934.

[1] Paper from the Department of Botany and the Herbarium of the University of Michigan No. 633.

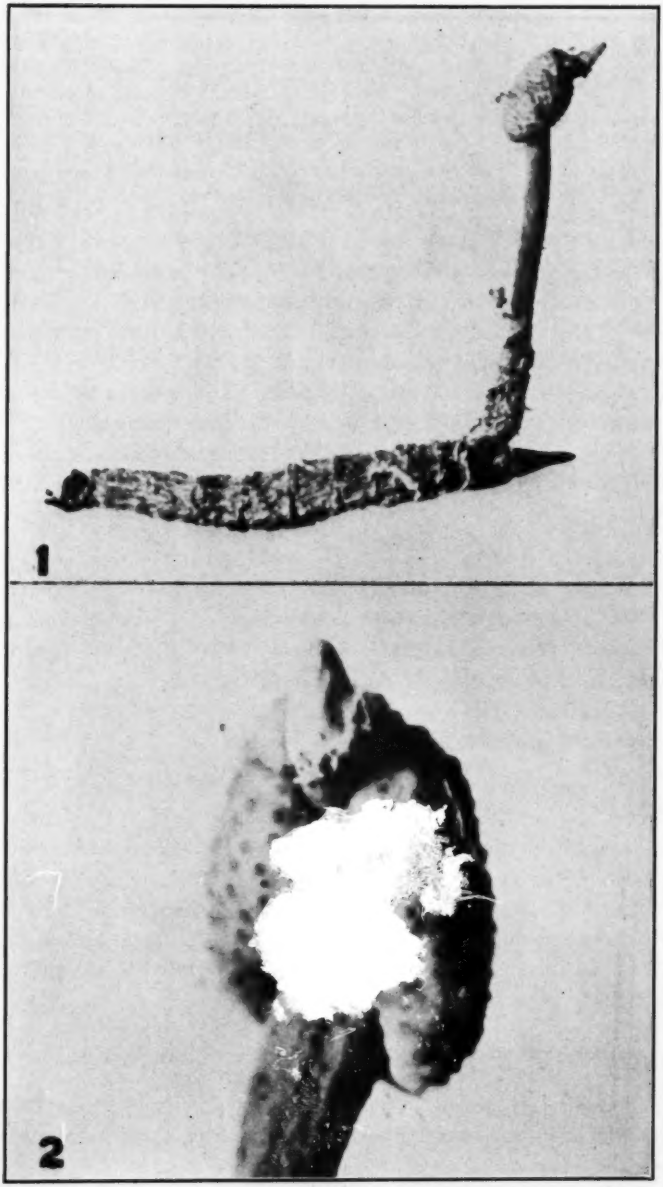


FIG. 1, clava of *Coryceps viperina*, × 5; 2, fertile cushion of stroma partly surrounding clava, × 18.

Clavae single mostly from the posterior portion of larvae, slender, 5–15 mm. long, 0.5 mm. thick, orange, acuminate at the apex; perithecia embedded in a pulvinate stroma, ovoid, 330–440 × 230–275 μ; ostioles short, slightly projecting; fertile stromata, pulvinate, 1.5–2.5 mm. wide, attached on one side below apices of clavae; asci cylindric, 8–10 μ wide and up to 330 μ long, the wall thickened abruptly at apex, up to 3 μ; ascospores filiform, parallel, nearly as long as the asci, multiseptate, beaking into segments 6–8 × 2 μ.

On larvae of a beetle in rotten logs, Brookside, Nova Scotia, July 25, 1931, L. E. Wehmeyer (*1213*); Earltown Road, Nova Scotia, Aug. 23, 1931, L. E. Wehmeyer (*1213a*); Catlin Lake, New York, Aug. 19, 1934, A. H. Smith (*387*, type); Seventh Lake, New York, Aug. 22, 1934, A. H. Smith (*425*); North Creek, New York, Sept. 10, 1934, A. H. Smith (*826*); Warrensburg, New York, Sept. 16, 1934, A. H. Smith (*883*); Lake Timagami, Ontario, Aug. 26, 1936, A. H. Smith (*4185*); Cohune Ridge, El Cayo District, British Honduras, July 13, 1936, E. B. Mains (*3837*).

CORDYCEPS MICHIGANENSIS Mains.

This species which has been known from only two locations in Michigan (**4**) was collected on Bear Island, Lake Timagami, Ontario, Sept. 4, 1936, by A. H. Smith (*4508*).

CORDYCEPS SUPERFICIALIS (Peck) Sacc.

This species was described by Peck (**5**) from a collection obtained at Northville, N. Y., Aug. 1874. Kauffman (**1**) reported it from a collection obtained at South Haven, Michigan in 1910. A specimen has been received from H. S. Jackson (*5043*) collected Aug. 16, 1933, on Bear Island, Lake Timagami, Ontario. A collection obtained by G. D. Darker at Norwood, Mass., has also been recently distributed from the Farlow Herbarium of Harvard University (Rel. Farl. *704*).

CORDYCEPS STYLOPHORA Berk & Br.

This is a rare species. Apparently it has previously been known only from Ravenel's collections in South Carolina and a collection

made by G. H. Hicks near East Lansing, Michigan, in 1892 (**4**). During the summer of 1934, A. H. Smith collected it repeatedly in New York at Warrensburg and Catlin Lake.

CORDYCEPS MELOLONTHAE (Tul.) Sacc.

A collection of this species obtained by A. H. Smith at Ann Arbor is the second record of the species for Michigan (**4**). Lloyd (**2**) has pointed out that the specimen of *Sphaeria herculea* Schw. in the Schweinitz herbarium is *Cauloglossum transversarium*. Mr. Don M. Benedict has kindly examined this specimen in the herbarium of the Philadelphia Academy of Science and agrees with Lloyd's conclusions. Both Lloyd (**3**) and Petch (**7**) have concluded that the name *Cordyceps Melolanthae* should apply to the fungus which has been passing under the name *C. herculea*.

OPHIOCORDYCEPS MACULARIS Mains.

This species has been known only from the type collected at Harbor Springs, Michigan (**4**). In September, 1934, A. H. Smith obtained one specimen at Kelm Mt., Warrensburg, N. Y.

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PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—XXVIII. A PROPOSED GENUS

FRED J. SEAVER

(WITH 1 FIGURE)

A recent collection of *Peziza aurantiopsis* Ellis has prompted a more extended study of this interesting species. It was included in North American Cup-fungi, but with the statement that its generic position was in doubt. It had some of the characters of *Bulgaria,* some of *Urnula,* and some of *Phillipsia,* but it failed to conform with any of these genera. A more recent study has convinced the writer that it is perhaps most closely related to *Urnula,* possessing the black mycelium and the corky consistency which is especially characteristic of *Urnula Geaster.* It can scarcely, however, be included as a species of that genus.

After a critical study of the species from fresh material the writer has decided to establish a new genus. Since the material prompting this study was sent by Dr. Frederick A. Wolf, it seems quite appropriate that the genus should be dedicated to him. Were this to be fitted into the scheme presented in North American Cup-fungi, it would probably appear in the Sarcoscypheae, between *Urnula* and *Bulgaria.* Following is the diagnoses of the proposed genus and the type species.

Wolfina gen. nov.

Apothecia gregarious, sessile or tapering into a thick stem-like base made up of a compact mass of dark brown or blackish mycelium with which the outside of the apothecium is also covered, shallow cup-shaped the substance of the hypothecium thick white and decidedly corky in dried specimens; hymenium concave of a reddish color; asci cylindrical, 8-spored; spores uniseriate comparatively large; paraphyses filiform only slightly enlarged above.

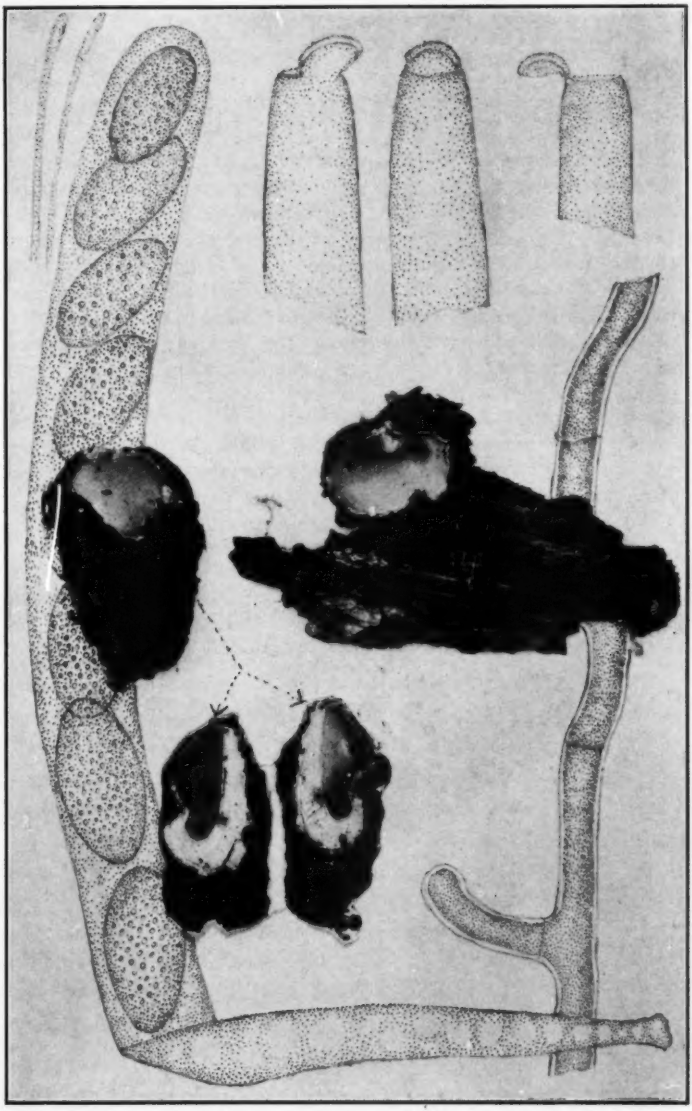


FIG. 1. *Wolfina aurantiopsis.*

Wolfina aurantiopsis (Ellis) comb. nov.

Peziza aurantiopsis Ellis, Bull. Torrey Club **9**: 18. 1882.
Lachnea aurantiopsis Sacc. Syll. Fung. **8**: 180. 1889.
Scutellinia aurantiopsis Kuntze, Rev. Gen. Pl. **2**: 269. 1891.

Apothecia gregarious, sessile, attached to the substratum by the entire under surface except the extreme margin which is free and slightly elevated and more or less incurved, externally brownish-black, the under side covered with numerous projecting folds, clothed with a dense growth of black mycelium, the substance within white, several mm. thick and in dried plants decidedly corky; hymenium pale-yellow or reddish, darker in dried plants; mycelium pale-brown, thin-walled, branched, septate, and externally often minutely rough; asci cylindric above, gradually tapering below into a stem-like base, reaching a length of 300 μ and a diameter of 17–18 μ; spores 1-seriate or with the ends slightly overlapping, broad-ellipsoid, granular within, hyaline or slightly yellowish, 16–18 $\times$ 27–33 μ; paraphyses slender, slightly enlarged above and hyaline or nearly so, reaching a diameter of 3–4 μ.

On bare soil and on decaying wood and leaves in low sandy oak and pine woods.

TYPE LOCALITY: Newfield, New Jersey.

DISTRIBUTION: New Jersey, Pennsylvania and North Carolina.

ILLUSTRATION: Seaver, Iowa Discom. *pl. 11, f. 2.*

THE NEW YORK BOTANICAL GARDEN

A DECAY OF ORNAMENTAL CACTI CAUSED BY ASPERGILLUS ALLIACEUS

J. J. Taubenhaus and G. E. Altstatt[1]

(with 1 figure)

During 1933, about 40 per cent of the plants in a large planting of ornamental cactus in southwest Texas were found dead or in a dying condition. Infected pads at first showed numerous small, depressed, irregular, bluish to dark-brown spots which soon coalesced into large, sunken water-soaked areas, the affected pads collapsing or falling over, and suggesting a damping-off condition. At other times infection started at the upper part of the pads, but for some reason decay was soon arrested, leaving the lower portion unaffected and from which new growth originated. Within a few days the affected tissue became covered with a white to yellowish mycelial growth and numerous large black sclerotia and fruiting heads characteristic of an *Aspergillus*.

In the field planting of ornamental cacti mentioned above, the following varieties were found equally susceptible: *Acanthocereus pentagonis, Ancistrocactus Scheeri, Echinocereus chloranthus, Epithelantha micromeris, Neomammillaria microcarpa, Opuntia leptocaulis,* and *Echinocactus horizonthalonius.*

Cause: The numerous isolations made from infected pad tissue yielded pure cultures of a fungus identified as *Aspergillus alliaceus* Thom and Church.[2] This organism was found to grow on a variety of media some of which were unfavorable for sclerotia production. On potato-dextrose or corn-meal agar, the fungus produced copious mycelial growth, an abundance of sporophores and spores, and typical large sclerotia (fig. 1 *a*). On lima bean agar, however, the fungus grew rather poorly and produced few

[1] Published with the approval of the Director as contribution No. *398* of the Texas Agricultural Experiment Station.

[2] Identification of this organism was checked by Dr. Charles Thom of the Microbiological Laboratory, Bur. Plant Industry, U. S. Dept. of Agriculture.

sporophores and spores and small sclerotia (FIG. 1 *b*). Platings on potato-dextrose agar, with hyphal tips, spores, and sclerotia resulted in typical colonies of *A. alliaceus*. In nature, the spread of the fungus is probably through spores, while the sclerotia may enable the organism to survive unfavorable soil and weather conditions, particularly during the hot summers of the South.

On a medium rich in carbohydrates, the mycelium of *A. alliaceus* is white and fluffy, gradually changes to a light-yellow, then to a deep-lemon color. Likewise, the young sporophores and spore heads are white but soon take on a yellow to brown color with age. The sclerotia are white when young, gradually turning brown, then dark, and are usually partly submerged in the substratum which has a tendency to wrinkle and crack, although the medium appears to be sufficiently moist. The measurements of the spores and of the sclerotia recovered from the ornamental cacti in Texas agree with those given by Thom and Church.[3]

Pathogenicity: During 1933, 12 normal potted cactus plants were obtained of each of the following varieties: *Acanthocereus pentagonis, Ancistrocactus Scheeri, Echinocereus chloranthus,* and the common spineless cactus, *Opuntia* sp. Both the pads and roots were carefully washed to remove all the soil, then dipped for one-half minute in a solution made up of 1–2000 bichloride of mercury in 25 per cent alcohol and rinsed three times in sterile water. The plants were then placed in moist chambers, six of each variety were inoculated through needle pricks with spores from a pure culture of *A. alliaceus* grown on potato-dextrose agar. Four other plants of each variety were inoculated through needle pricks with surface sterilized sclerotia from the same pure culture. The remaining two plants of each variety were pricked with a sterile needle and used as checks. Irrespective of the type of inoculum used, the inoculated plants developed typical decay and soon became covered with the characteristic mycelium, conidiophores, and sclerotia of the fungus, while uninoculated plants remained normal. Two replications of this series were made with similar results. The fungus was readily recovered from inoculated pads, proving that *A. alliaceus* is capable of causing a disease of ornamental

[3] Thom, Charles, and M. B. Church. The Aspergilli, p. 163. Williams & Wilkins Co. Baltimore. 1936.

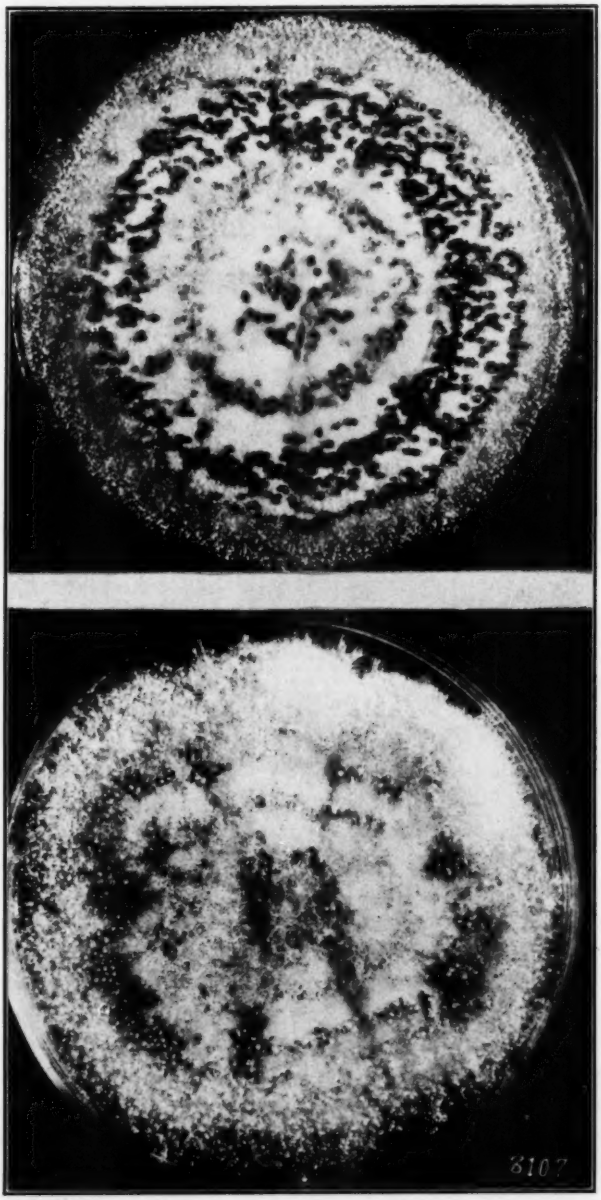


FIG. 1. Growth of *Aspergillus alliaceus* on two different media, (above) on potato-dextrose agar, (below) on lima bean agar.

cacti. However, no infection resulted when the inoculum was placed on the unbroken epidermis of the pads even though they were kept under moist conditions, indicating that the fungus is probably a wound parasite only. Under field conditions, it is quite possible that insects or rodents may open the way to infection.

Susceptibility of hosts other than cacti: An attempt was made to determine whether *A. alliaceus* is able to infect various fruits and vegetables at room temperature. Inoculations were made on

TABLE 1

RESULTS OF INOCULATIONS OF VARIOUS HOSTS WITH SPORES AND SCLEROTIA OF *Aspergillus alliaceus* FROM ORNAMENTAL CACTUS. INOCULATIONS MADE AT VARIOUS INTERVALS FROM MARCH TO AUGUST, 1932

Host Inoculated	Type of Inoculum				Checks, Uninoculated, Needle Prick Only	
	Spores		Sclerotia			
	Number Inoculated	Number Infected	Number Inoculated	Number Infected	Number Pricked	Number Infected
Spineless cactus, *Opuntia* sp.	12	11	12	9	7	0
Apple, var. Delicious	8	8	8	8	6	0
Banana*	12	12	12	12	5	0
Orange, var. Valencia	9	7	14	13	7	0
Pineapple	7	7	9	9	5	0
Beets, var. Crosby Egyptian	18	0	12	0	7	0
Cabbage*	5	0	5	0	3	0
Carrots*	12	0	12	0	12	0
Cucumber, var. Chicago Pickling	7	6	7	6	6	0
Eggplant*	5	5	5	3	5	0
Onion, var. White Bermuda	57	44	41	37	28	0
Pepper*	17	17	14	14	7	0
Potato, var. Red Triumph	25	0	25	0	20	0
Tomato, var. Marglobe	58	58	62	57	25	0
Turnip, var. Purple Top	10	9	14	11	9	0

* Variety unknown.

oranges, apples, tomatoes, Irish potatoes, eggplants, beets, pineapples, onions, carrots, peppers, cucumbers, bananas, and cabbage. Inoculations were made by needle pricks using either spores or sclerotia as the inoculum, after which the inoculated material was placed in moist chambers. From results in Table 1, it is noted that infection was obtained only in soft tissue fruits such as oranges, apples, tomatoes, eggplants, pineapples, onions, turnips, peppers, cucumbers, bananas, and cactus pads. No infection was secured on hard vegetables such as Irish potatoes, beets, carrots,

or cabbage. The symptoms on the several hosts inoculated differed but slightly from each other. In most cases, the inoculated material became soft, leaky, and covered by the characteristic hyphal growth, sclerotia, and sporophores of *A. alliaceus*. No infection resulted on any of the fruit or vegetables listed in Table 1, when the inoculum was placed on an unbroken epidermis, indicating further that *A. alliaceus* is probably a wound parasite.

Walker and Murphy [4] reported two interceptions of *A. alliaceus* on decayed garlic imported from Italy into the United States, and succeeded in artificially infecting onions and garlic with a pure culture of this fungus. About the same time, Thom isolated *A. alliaceus* from a blister beetle in the United States. This would indicate that the fungus is probably of wide distribution, particularly in temperate and sub-tropical regions.

Control: During 1934, attempts were made to control this disease under field conditions with 4–4–50 Bordeaux mixture. In a field planting in southwest Texas of *Ancistrocactus Scheeri,* an ornamental cactus, 200 plants were divided into four equal plats. In Plat 1, the plants were sprayed with Bordeaux mixture; in Plat 2, both plants and soil were sprayed with Bordeaux mixture; in Plat 3, plants and soil were dusted with a commercial powdered dry Bordeaux; and in Plat 4, the plants left as checks. Although new infection appeared in all of the four plats, the best control was obtained in Plat 2 which had four per cent of the plants infected. On the other hand, 40 per cent infection occurred in Plat 3, 27 per cent in Plat 1, and 70 per cent in the check plat.

Summary: A. alliaceus is recorded as causing a pad decay of several species of ornamental cacti. This is believed to be the first record of the organism causing a decay of cultivated plants in the United States. The disease was reproduced by artificial inoculation on normal cactus pads, using either spores or sclerotia of the fungus as the source of inoculum. Successful inoculation occurred only when the organism was introduced through needle pricks. *A. alliaceus* was also shown to be able to cause a decay of several mature fruits and vegetables at room temperature. As with the inoculations on cacti, infection resulted only when the spores or the sclerotia of the fungus were introduced through needle pricks.

[4] Walker, J. C. and Albert Murphy. Onion bulb decay caused by *Aspergillus alliaceus*. Phytopath. **24**: 289–291. 1934.

THE SPECIES CONCEPT IN CORTICIUM CORONILLA [1]

ROSEMARY BIGGS [2]

(WITH 26 FIGURES)

The Thelephoraceae include the simplest and least known members of the Hymenomycetes in which the hymenium shows no gross morphological differentiation. The distinction of species in the thin resupinate forms must rest almost exclusively on microscopic details. In the absence of a clear knowledge of the interrelationships within the group the choice of diagnostic characters must be to some extent arbitrary and as the concept of the family enlarges it is becoming evident that many of the microscopic features, at present emphasized in the descriptions of species, are inconsistent. For example, considerable importance is now attached to such characteristics as the presence or absence of incrusting material in the subiculum, the arrangement of the substratal hyphae, and the thickness of the fructification (Burt, **1926**). In certain species these characters may be consistent and therefore of systematic value, on the other hand, in other species a sufficient number of specimens will include all possible variations of these characters. In addition to the confusion caused by the emphasis of inconsistent features, many of the common species show such a wide range of variation, when a large number of specimens are examined, as to suggest the inclusion of several species. In such cases, however, it is often difficult to find any clearly distinguishing characters.

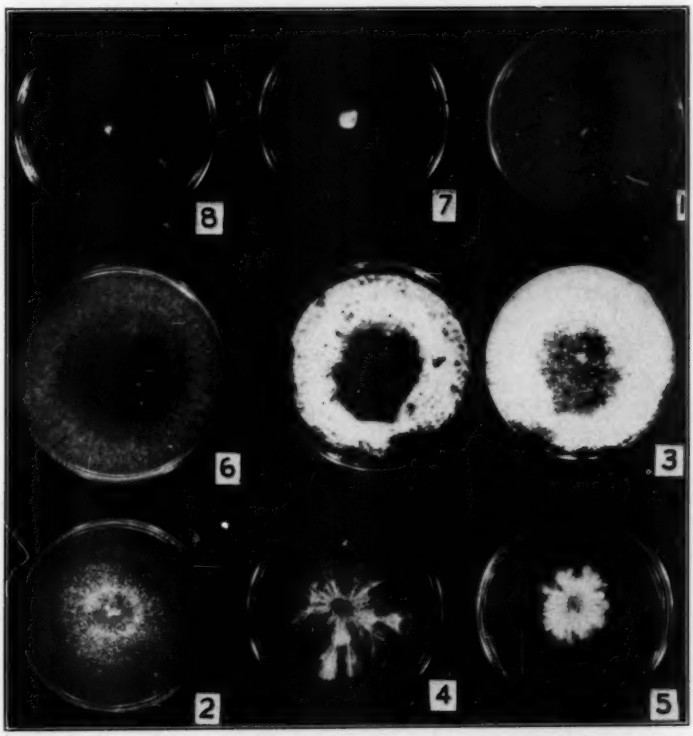
From attempts to work with these forms it has become evident that a more exact definition of the species concept in this group is extremely desirable. It was thought that a study of the cul-

[1] Contribution from the Department of Botany, University of Toronto.

[2] This study has been made under the direction of Dr. H. S. Jackson, to whom I wish to express my appreciation for his continued interest and helpful suggestions.

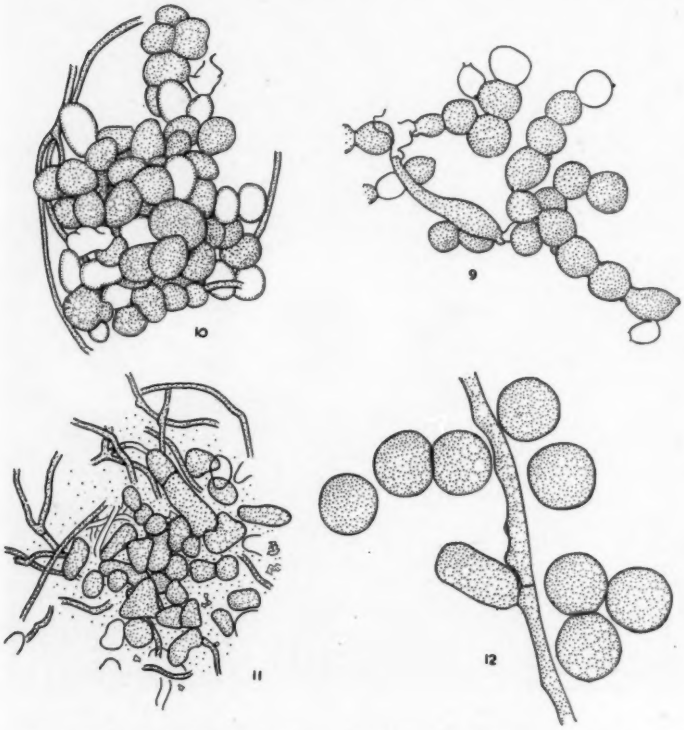
tural characters and pairing reactions within one of the more confusing species might provide additional criteria for the determination of relationships.

With this aim in view a study was made of a group of related



FIGS. 1–8. Growth characters of groups I–IV of *Corticium coronilla;* 1, group I, no. 585, 17 day culture, submerged growth covers the entire plate; 2, group II, no. 617, 17 day culture, conspicuous aerial mycelium; 3, group II, no. 617, 6 weeks culture, conspicuous basidiospore hymenium which has deposited a heavy white mass of spores on petri dish lid (left); 4, group III*a*, no. 773, 17 day culture, rhizoidal growth, pale brown bulbils produced at the centre of the colony; 5, group III*a*, no. 566, 17 days growth, pale brown bulbils at the centre of the colony; 6, group III*b*, no. 831, 17 day culture, rapid growth, cottony aerial mycelium, dark brown bulbils at the centre of the colony; 7, group III*a*, no. 566, 17 day culture, monosporous culture of limited growth; 8, group IV, no. 647, 17 day culture, very slight growth. All photographs × ⅓.

organisms which grow as thin white or yellowish films on decaying wood and which produce characteristic basidia, described as coronate and urniform. In these fungi a small ellipsoid probasidium is first formed, from the upper end of this a narrower neck grows out and at the apex of this a crown of five to eight sterigmata and



FIGS. 9–12. 9, bulbil-like cells produced by group II, no. 617; 10, true bulbil produced by group III*a*, no. 773; 11, mass of bulbil-like cells produced by a monosporous mycelium of limited growth, group III*a*, no. 566; 12, detachable swollen cells of group IV, no. 647. Magnified × 665.

spores are produced (FIGS. 21–26). The wide range of structure occurring among the fungi answering to this general description has led to the recognition of four species of *Corticium* and one of *Grandinia*, viz.: *Corticium coronilla* v. Höhn. & Litsch., *C. octo-*

sporum Schroet., *C. diademiferum* Bourd. & Galz., *C. niveocremeum* v. Höhn. & Lit., and *Grandinia Brinkmanii* (Bres.) Bourd. & Galz. A recent study by Rogers (**1935**) has led to the conclusion that these species are intergrading and that for practical purposes distinction is impossible. Rogers therefore includes all five species under the name *Sistotrema coronilla* (v. Höhn. & Lit.) Rogers. This new combination stresses the relationship implied in the presence of coronate urniform basidia in the genus *Sistotrema* but ignores the wide differences in organisation between the thin *Corticium* species and the stipitate hydnoid *Sistotrema confluens* Pers., the type species of the genus *Sistotrema*. There can be little doubt that the type of the basidium

TABLE I

CULTURES OF *Corticium coronilla* v. Höhn. & Lit.

Group Number	Culture Number	U. of T. Herbarium Number	Number of Monosporous Cultures	Number of Polysporous Cultures	Type of Heterothallism	Cultural Peculiarities
I	585	10260	14	2	Bipolar	Mycelium submerged and hyphae finally agglutinated and indistinct
	586	10240	15	2	Bipolar	
	628	10263	8	2	Bipolar	
	629	10241	10	2	Bipolar	
	687	10257	15	2	Bipolar	
II	494	8218	25	2	Homothallic	Cultures produce basidia
	617	10267	20	2	Homothallic	Cultures produce basidia
	673		0	3	?	Bulbil-like cells and basidia produced
	709	10268	20	2	Homothallic	Cultures produce basidia
	714		0	3	?	Bulbil-like cells and basidia produced
	817	10266	37	2	Homothallic	Bulbil-like cells and basidia produced
IIIa	566	10246	26	2	Tetrapolar	Bulbils and oidia produced
	773	10244	14	2	Tetrapolar	
IIIb	831	10247	16	2	Tetrapolar	Bulbils and oidia produced
IIIc	506	Farlow Herbarium	0	2	?	Bulbils and oidia produced
IV	647	10248	5	2	Heterothallic	Slow mycelial growth, wide hyphae. Large spherical cells which separate from the mycelium
	671	10254	0	2	?	
	674	10250	0	2	?	
	677	10251	0	2	?	
	680	10249	0	2	?	
	736	10253	0	2	?	
	753	10252	0	2	?	
Additional cultures not referred to groups I–IV	519	10269	10	2	?	Bulbil-like cells produced
	584	10262	0	2	?	
	636	10242	0	2	?	Growth similar to that of group I
	720	10255	0	2	?	
	733	10245	0	2	?	
	779	10243	0	2	?	

is of fundamental phylogenetic importance. On the other hand, the whole basis of the generic and family classification most commonly in use in the Hymenomycetes rests on differences in gross morphology. This classification is, with little doubt, quite artificial but until the knowledge of the group as a whole is sufficiently advanced to warrant a general reorganisation on a more rational basis it would seem unwise to ignore the orthodox distinctions in any one isolated instance. For this reason, the comprehensive conception of the species *Sistotrema coronilla* (v. Höhn. & Lit.) Rogers is recognized but the name *Corticium coronilla* v. Höhn. & Lit. is retained to represent this collective entity.

Specimens referable to this species are extremely common in Ontario and cultures are easily made. From fourteen specimens sets of monosporous cultures were obtained. A list of these cultures is included in Table I.

Among these cultures four distinct groups could be recognized. These were so clearly delimited that a study of the cultures alone would give no indication that the original specimens of the different groups were in any way closely related.

The cultural characters of these four groups will first be described and then some attempt will be made to correlate these characters with the peculiarities of the original specimens.

Group I

In the first group, five sets of monosporous cultures were obtained. In these the growth on agar is rapid and mostly submerged (FIG. 1). The hyphae are of narrow diameter and, in the older parts of the colony, become so agglutinated as to be very indistinct. The polysporous cultures show clamp connections at every cross wall whereas the hyphae of the monosporous cultures are devoid of clamps. The individual monosporous cultures within each of the five sets of cultures were paired in all possible combinations. The pairing reactions were very indistinct. It was often impossible to find clamps in theoretically positive quadrants of the tables and occasionally the hook of the clamp failed to fuse with the penultimate cell as in the false clamp connections described by Quintanilha (**1935**). It was found that many of the unex-

pected negative reactions could be rendered positive by growing the two haplonts together on a thin film of agar. Under these conditions the hyphae would often develop clamp connections when these failed to appear in the tube cultures. In spite of the poor pairing reactions, the monosporous cultures of each of the five sets

		A_5								a_5									
		4	5	9	12	13	14	16	18	1	2	3	6	7	8	10	11	15	17
A_5	4	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+
	5	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+
	9	−	−	−	−	−	−	−	−	+	+	+	+	−	+	+	+	+	−
	12	−	−	−	−	−	−	−	−	+	+	−	+	+	+	+	+	+	+
	13	−	−	−	−	−	−	−	−	+	+	+	+	+	−	+	−	+	+
	14	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	+	+
	16	−	−	−	−	−	−	−	−	+	+	+	+	+	−	−	+	+	+
	18	−	−	−	−	−	−	−	−	+	+	−	+	+	−	+	+	+	+
a_5	1	+	+	+	+	+	−	+	+	−	−	−	−	−	−	−	−	−	−
	2	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
	3	+	+	+	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	6	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
	7	+	+	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
	9	+	+	+	+	−	+	−	−	−	−	−	−	−	−	−	−	−	−
	10	+	+	+	+	+	+	−	+	−	−	−	−	−	−	−	−	−	−
	11	+	+	+	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−
	15	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
	17	+	+	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−

TABLE II

PAIRING REACTIONS OF 18 MONOSPOROUS MYCELIA OF *Corticium coronilla* GROUP I, NO. 687. + = NORMAL CLAMP CONNECTIONS. + = POOR REACTION. − = ABSENCE OF CLAMP CONNECTIONS.

could be separated into two groups indicating a bipolar type of heterothallism. A typical table of pairing reactions is included as Table II. When representative monosporous mycelia from different sets of cultures were paired all the reactions were positive (Table III).

TABLE III

PAIRING REACTIONS OF REPRESENTATIVE MONOSPOROUS MYCELIA FROM FIVE COLLECTIONS OF *Corticium coronilla* GROUP I

			585				628				629				687			
			A_1		a_1		A_3		a_3		A_4		a_4		A_5		a_5	
			3	8	2	5	1	2	3	8	2	3	7	9	4	5	1	15
586	A_2	1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	a_2	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

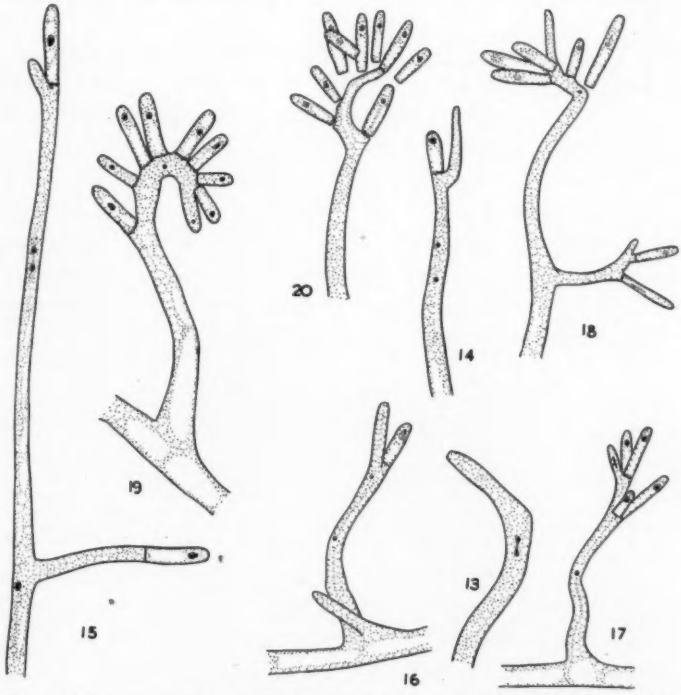
Group II

From four of the six specimens separated in the second group, sets of monosporous cultures were obtained and from two polysporous cultures were isolated. In all these cultures the growth is rapid and a considerable amount of aerial mycelium develops. Both monosporous and polysporous cultures show more or less of a tendency to produce basidia (FIGS. 2 and 3). In three strains (no. 673, no. 714 and no. 817) some large rather thickwalled cells occur. These bear a marked resemblance to the constituent cell of the bulbils described for group III and to the swollen cells of group IV (FIGS. 9–12). The hyphae of both monosporous and polysporous cultures develop clamp connections indicating that the fungi in this group are homothallic. A cytological study showed that the basidia regularly contain fusion nuclei, the spores are uninucleate and the hyphae are binucleate. The homothallism of this strain may be compared with that of *Coprinus sterquilinus* Fries described by Miss Mounce (**1921**) and others. In this species also the hyphae produced clamp connections and the whole life cycle is completed from a single nucleus.

Group III

From three specimens included in this group sets of monosporous cultures were obtained and from one other a polysporous culture

was isolated. In all of these cultures a conspicuous aerial mycelium is produced and the central portion of the colony is covered by masses of brown bulbils (FIGS. 4, 5, 6). These bulbils are small groups of fungus cells which become differentiated and agglutinated together, and finally separate from the vegetative my-



FIGS. 13–20. Successive stages in oidial production in *Corticium coronilla* group III*a*, no. 566. Magnified × 1600.

celium (FIG. 10). In addition to the bulbils produced in both the monosporous and polysporous cultures, oidia are produced in sympodial clusters on aerial branches of the monosporous mycelia. These aerial hyphae are normal haploid hyphae with uninucleate cells on which the oidiophores occur as wide angled side branches. On each of the oidiophore side branches oidial development takes place successively. The nucleus of the oidiophore divides and

one of the daughter nuclei passes to the tip of the hypha and is cut off in an oidium (FIGS. 13–20). A second oidium forms at the base of the first and the oidiophore nucleus again divides. The second oidium tends to assume a terminal position. Development proceeds in this sympodial fashion until a small head of oidia is formed. As far as could be ascertained these oidia are consistently

		A_1B_1						a_1b_1			a_1B_1					A_1b_1				
		8	11	13	15	19	20	1	3	12	7	9	10	14	17	18	2	4	5	6	16
A_1B_1	8	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	11	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	13	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	15	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	19	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
	20	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−
a_1b_1	1	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
	3	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
	12	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
a_1B_1	7	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+
	9	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	+	+	+
	10	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+
	14	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−	+	+
	17	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+
	18	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+
A_1b_1	2	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−
	4	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−
	5	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−
	6	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−
	16	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−

TABLE IV

PAIRING REACTIONS OF 20 MONOSPOROUS MYCELIA OF *Corticium coronilla* GROUP III*a*, No. 566

absent from the diploid, polysporous cultures. The hyphae of the monosporous cultures lack clamp connections, while those of polysporous origin produce clamps. When the monosporous cultures from a single fructification were paired in all possible combinations these could be separated into four groups with regard to the production of clamp connections indicating a tetrapolar type of hetero-

thallism. The pairing reactions of one set of monosporous cultures, no. 566, are given in Table IV.

There is some variation in this group suggesting the separation into three subgroups:

Subgroup a

In this subgroup two sets of monosporous cultures, no. 566 and no. 773 belong. The polysporous cultures of these fungi develop a conspicuous aerial rhizoidal growth and the bulbils are of a pale-brown color (FIGS. 4 and 5). In no. 773 the monosporous cultures are similar to those of polysporous origin. In no. 566, on the other hand, the monosporous cultures show a striking variation. In some the growth is similar to that of the polysporous cultures while in others an extremely limited growth occurs and the mature colony is an irregular mass of agglutinated hyphae in which bulbil like cells occur but no true bulbils are produced (FIGS. 7 and 11).

When representative monosporous mycelia from no. 773 and no. 566 were paired, clamps were produced in all combinations (Table V).

Subgroup b

To this subgroup the set of monosporous cultures, no. 831, belongs. In both monosporous and polysporous cultures a cottony aerial mycelium is developed which shows no tendency to rhizoidal growth. The bulbils produced are of a dark brown color (FIG. 6). When representative monosporous cultures of no. 831 were paired with those of no. 773 the reaction was completely negative (Table V).

The fungus separated in this subgroup is evidently related to the fungi in subgroup *a*. Bulbils and oidia are produced in both subgroups and in both the heterothallism is of the tetrapolar type. On the other hand, the lack of rhizoidal growth, the different color of the bulbils and the failure to react with one another would indicate that the two are distinct.

TABLE V

PAIRING REACTIONS OF REPRESENTATIVE MONOSPOROUS MYCELIA OF GROUP III*a*, NO. 566 AND NO. 773, AND GROUP III*b*, NO. 831

			566					831			
			a_1b_1	A_1b_1	A_1B_1	a_1B_1		a_2B_2	a_2b_2	A_2B_2	A_2b_2
			1	2	8	10		1	2	3	5
773	A_2B_2	1	+	+	+	+		−	−	−	−
	a_2b_2	5	+	+	+	+		−	−	−	−
	A_2b_2	4	+	+	+	+		−	−	−	−
	a_2B_2	8	+	+	+	+		−	−	−	−

Subgroup c

One polysporous culture is placed in this subgroup. The cultural characters of this fungus are similar to those of the fungi in subgroup *a*. However, the microscopic characters of the specimen, to be described later, are very distinct and had monosporous cultures been available it is very probable that these would have failed to react with the other groups.

It is interesting to note that this group of *Corticium coronilla* almost certainly includes the fungus previously described by Lyman (**1907**) under the name of *Corticium alutaceum* (Schrad.) Bres. The bulbils and oidia produced by *Corticium coronilla* group III correspond exactly to those described by Lyman. Cultures have been repeatedly obtained from collections of *Corticium radiosum* Fries, to which species Burt (**1926**) assigns *C. alutaceum* as a synonym, and neither bulbils nor oidia were ever observed. The description given by Lyman (**1907**) for the specimen of "*Corticium alutaceum*" from which his cultures were obtained states that the fungus was thin, with a rather indeterminate sometimes fibrillose edge, with basidia bearing four to eight sterigmata. Associated with these hymenia conspicuous bulbil fructifications occurred. This description is more reminiscent of *Corticium coronilla* than *Corticium radiosum*. Further, specimens under the name of *Corticium alutaceum* were obtained from the Farlow herbarium, having been collected in the same general region from

which Lyman obtained his material. These specimens lacked well developed hymenia but the general appearance was very similar to that of *Corticium coronilla* group III (*c*). Finally this specimen of group III (*c*) was sent by Dr. Linder, having been collected in the region in which Lyman worked. From this it would seem evident that the fungus described by Lyman was in no way related to *Corticium radiosum* Fries, but was very similar to *Corticium coronilla* v. Höhn. & Lit. group III. Lyman's strain was probably distinct from the three strains of *C. coronilla* group III described, the spores were said to measure 3.8–4.5 × 5.8–6.5 μ, which is considerably larger than those found in any of the specimens studied.

Although bulbils are always present in the cultures of the fungi assigned to Group III these structures were only found associated with the specimen of group III *c* (no. 506). The reason for the absence of bulbils from the specimens of group III *a* and *b* was not determined. It is, however, possible that these structures are produced most readily in the spring. The specimen of *C. coronilla* group III *c* and the bulbil producing specimens referred to *C. alutaceum* were collected early in the season, while the specimens of group III *a* and *b* were collected between July and October. Had these specimens been collected in the spring it is possible that bulbils might have been found in association with the hymenium.

Group IV

In this group one small set of five monosporous cultures was obtained and from four additional specimens polysporous cultures were isolated. In contrast to the three first groups, in which the spores germinated readily on agar, the spores of the fungi in this group germinated only after a rest of three or four days and then in very low percentage. The growth on agar is very slow (FIG. 8). The hyphae which are of wide diameter and not at all agglutinated produce an abundance of conspicuous spherical cells which finally become detached (FIG. 12). These spherical cells are large and more in the nature of chlamydospores than conidia; they bear some resemblance to the swollen cells produced by the

fungi in group II and to the constituent cells of the bulbils in group III. A relationship between the fungi in these three groups may be indicated by the similarity of these structures. The few monosporous cultures which were obtained failed to develop clamp connections and on pairing could be separated into two groups. This strain is then evidently heterothallic.

TABLE VI

PAIRING REACTIONS OF REPRESENTATIVE MONOSPOROUS MYCELIA OF *Corticium coronilla* GROUP I, NO. 568, WITH GROUP III*a*, NO. 566 AND NO. 773, GROUP III*b*, NO. 831, AND GROUP IV, NO. 647

			566				773				831				647			
			a_1b_1	A_1b_1	A_1B_1	a_1B_1	A_2B_2	a_2B_2	A_2b_2	a_2B_2	a_3B_3	a_3b_3	A_3B_3	A_3b_3	A		a	
			1	2	8	10	1	5	4	8	1	2	3	5	1	4	2	3
586	A_2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	a_2	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE VII

PAIRING REACTIONS OF REPRESENTATIVE MONOSPOROUS MYCELIA OF *Corticium coronilla* GROUP IV, NO. 647, WITH GROUP III*a*, NO. 773, AND GROUP III*b*, NO. 831

			773					831			
			A_2B_2	a_2B_2	A_2b_2	a_2B_2		a_3B_3	a_3b_3	A_3B_3	A_3b_3
			1	5	4	8		1	2	3	5
647	A	1	–	–	–	–		–	–	–	–
		4	–	–	–	–		–	–	–	–
	a	2	–	–	–	–		–	–	–	–
		3	–	–	–	–		–	–	–	–

When test monosporous mycelia from groups I, III and IV were paired with each other the reactions were negative in all combinations (Tables VI and VII).

Recapitulating these results, the fungi in group I are characterized by a rapid growth of submerged hyphae and the hetero-

thallism is of the bipolar type. The fungi in group II tend to produce basidia in artificial culture and all the monosporous mycelia develop clamp connections, indicating that the strain is homothallic. The fungi in group III all produce bulbils and oidia and in all the heterothallism is of the tetrapolar type. In group IV the fungi do not grow readily in culture, the hyphae are of wide diameter and produce conspicuous spherical swellings.

Since the fungi could so readily be separated into four groups on their cultural characters, the original specimens were examined in order to establish some correlated morphological peculiarities. In the following descriptions the minute differences, which were associated with each of the groups, have been stressed.

Group I (FIG. 21)

Fructification delicate, coarsely powdery with some tendency to develop *Grandinia* granules. Edge indeterminate. Subiculum usually with some included crystalline matter. Hyphae distinct or indistinct according to the specimen, usually about 3 μ in diameter. Basidia usually 12–14 $\times$ 3–4 μ. Spores ellipsoid, cylindric, not curved, 1.8–2 $\times$ 3–4.5 μ.

Specimens examined: Ontario: Temagami, R. Biggs, Univ. of Toronto Herb. numbers *10240, 10241, 10257, 10260;* Temagami, H. S. Jackson, Univ. of Toronto Herb. number *10263.*

Group II (FIG. 22)

Fructification usually thicker than in group I, producing conspicuous *Grandinia* granules. Edge indeterminate. Hyphae distinct or indistinct, usually rather irregular, 2–5 μ in diameter. Basidia very variable 3–4 $\times$ 13–20 μ. Spores cylindric and usually curved 1.8–2 $\times$ 3.5–5 μ.

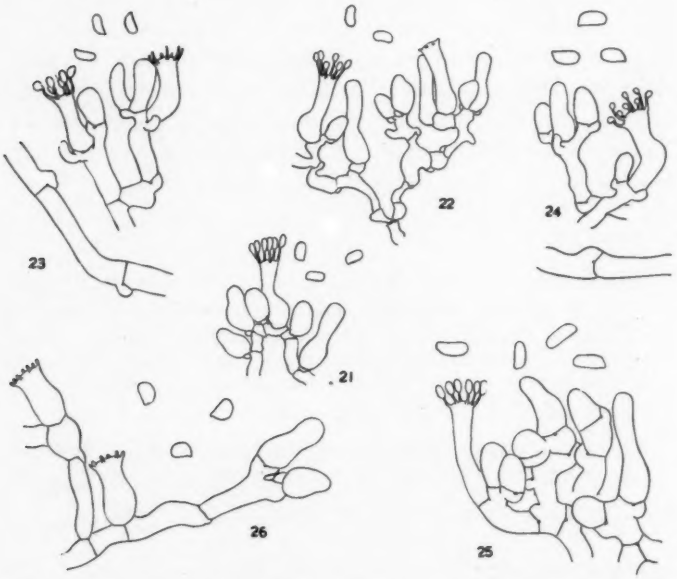
Specimens examined: Ontario: Temagami, R. Biggs, Univ. of Toronto Herb. numbers *10264, 10265, 10267, 10268;* Brant County, R. F. Cain, Univ. of Toronto Herb. number *10266.*

Group III (a) (FIG. 23)

Fructification pellicular with a distinct fibrillose edge, with a slight tendency to produce *Grandinia* granules. No included crystalline matter. Hyphae very distinct of even diameter 5–6 μ

wide. Basidia with a conspicuous clamp at the base, 3–4 × 12–14 μ. Spores ellipsoid flattened on one side 1.8–2 × 3–3.5 μ.

Specimens examined: Ontario: Temagami, R. Biggs, Univ. of Toronto Herb. numbers *10244, 10246.*



FIGS. 21–26. Basidia and spores of *Corticium coronilla* groups I–IV; 21, group I, no. 585; 22, group II, no. 617; 23, group III*a*, no. 773; 24, group III*b*, no. 831; 25, group III*c*, no. 506; 26, group V, no. 647. Magnified × 700.

Group III (b) (FIG. 24)

Fructification pellicular smooth. Edge thinning out but not fibrillose. Subiculum lacking included crystalline matter. Hyphae abundant and distinct, of even diameter 5–6 μ wide. Basidia with a conspicuous clamp at the base usually 4–5 × 13–15 μ. Spores ellipsoid flattened on one side 2–2.5 × 4–4.5 μ.

Specimens examined: Ontario: Toronto, H. S. Jackson, Univ. of Toronto Herb. number *10247.*

Group III (c) (FIG. 25)

Fructification pellicular, smooth. Edge distinctly fibrillose. Light brown sandy masses of bulbils associated with the hymenium. Hyphae abundant, distinct and of even diameter 5–7 μ wide. Basidia conspicuously larger than in other specimens 4.5–6 $\times$ 18–20 μ. Spores ellipsoid, sometimes slightly curved 2.5–3 $\times$ 5–5.5 μ.

Specimens examined: Massachusetts: Medford, Linder, Farlow Herb.

TABLE VIII

CHARACTERS OF SPECIMENS OF *C. coronilla* GROUPS I–IV

Group Number	Spore Characters	Basidia	Character of Hyphae and Subiculum	General Appearance of Specimen
I	1.8–2×3–4.5 μ ellipsoid not curved	Variable, most usually 3–4 ×12–14 μ	Subiculum with some incrustation, hyphae sometimes distinct 3 μ	Delicate, coarsely powdery edge indeterminate, with a general tendency to grandinioid granulations
II	1.8–2×3.5–5 μ ellipsoid curved	Very variable, 3–4×13–20 μ	Subiculum with conspicuous incrustation. Hyphae 2–5 μ	Rather thick, edge indeterminate, all specimens with distinct grandinioid granulations
III*a*	1.8–2×3–3.5 μ ellipsoid flattened on one side	3–4×12–14 μ	Subiculum hyphae regular and distinct 5–6 μ. No incrustation	Pellicular with a rhizoidal fibrillose edge
III*b*	2–2.5×4–4.5 μ ellipsoid flattened on one side	4–5×13–15 μ	Subiculum hyphae regular and distinct 5–6 μ. No incrustation	Pellicular. Edge indeterminate
III*c*	2.5–3×5–5.5μ ellipsoid curved	4.5–6×18–20 μ	Subiculum hyphae regular and distinct 5–6 μ. No incrustation	Pellicular. Edge rhizoidal. Masses of pale brown bulbils found in association
IV	2–3×3.5–4.5 μ ellipsoid-subglobose flattened on one side	5.5–6×12–13 μ	Subiculum hyphae of wide diameter and often irregular 5–6 μ	Very delicate with no grandinioid granulations. Edge indeterminate

TABLE IX
CULTURAL CHARACTERS OF *C. coronilla* GROUPS I–IV

Group Number	Hyphae	Heterothallism	Fructification	Growth and General Appearance
I	Usually agglutinated and indistinct	Bipolar	None	Growth rapid submerged, no microscopic distinguishing characters
II	Often agglutinated and indistinct up to 5 or 6 μ	Homothallic	In both monospore and polyspore cultures	Growth rapid and always some aerial mycelium. Several specimens produce bulbil-like cells
III*a*	Distinct 5–7 μ	Tetrapolar	None	Growth mediumly rapid with conspicuous aerial rhizoidal strands. Bulbils and oidia produced
III*b*	Distinct 5–7 μ	Tetrapolar	None	Growth rapid and lacking rhizoidal strands. Aerial mycelium cottony. Bulbils and oidia produced
III*c*	Distinct 5–7 μ	?	None	Growth medium rapid with conspicuous aerial rhizoidal strands. Bulbils and oidia produced
IV	Distinct 5–7 μ	Heterothallic	None	Growth very slow and almost entirely submerged. Conspicuous separable spherical cells produced apically or in chains

Group IV (FIG. 26)

Fructification very delicate, rather coarsely powdery with no tendency to produce *Grandinia* granules. Edge indeterminate. Subiculum scanty, lacking incrustation. Hyphae usually distinct, rather irregular, 5–6 μ in diameter with occasional swellings up to 8 or 9 μ. Basidia shorter and broader than in the other groups, 5.5–6 $\times$ 12–13 μ. Spores short ellipsoid to subglobose, flattened on one side 2–3 $\times$ 3.5–4.5 μ.

Specimens examined: Ontario: Temagami, R. Biggs, Univ. of Toronto Herb. numbers *10248, 10249, 10250, 10251, 10252, 10253, 10254.*

From these descriptions it is obvious that distinct, though minute

differences can be distinguished between the specimens of the fungi belonging to each of the four cultural groups.

From tables VIII and IV the general characters of the specimens can be correlated with those of the corresponding cultures. It is interesting to note that the characters of the specimens are often comparable to those of the cultures. For example, the fungi in group IV develop delicate fructifications in nature and grow poorly in culture. The fungi in group III*a* and *c*, which develop a rhizoidal growth in culture, also show a fibrillose edge in nature. The fungi in which the hyphae become agglutinated in culture often show indistinct hyphae in nature, etc.

DISCUSSION

The problems which are most immediately suggested by these results are: (1) Do the four groups described represent the only growth types within the species? (2) Do these growth types represent distinct species, and if so do they correspond with any of the hitherto described species?

To consider the first problem. It is quite certain that the growth varieties described are but four of an indefinite number of similar varieties.

In the first place, cultural studies with an additional specimen, no. 519, have shown that this is probably distinct. The growth on agar is slow, submerged and different from that in the other groups. Some relationship to group III is possibly indicated by the occurrence of bulbil-like masses in the submerged mycelium. The monosporous cultures from this strain failed to pair with those of any of the other groups. An examination of the original specimen showed that this also differs considerably from the specimens of the other groups. The general appearance is extremely delicate and the internal structure agglutinated and indistinct. This specimen was not included as group V of *C. coronilla* for the sole reason that it was considered unsatisfactory to base any general conclusions on a single specimen.

In addition to the culture no. 519, a number of polysporous cultures were obtained from additional specimens whose growth on agar is comparable to that of the fungi in group I. The growth

characters of this group are, however, essentially negative and in the absence of pairing reactions it would be impossible to be certain of their relationships. The specimens corresponding to these additional polysporous cultures show a wide range in general appearance and spore size and shape. In the fungi definitely assigned to group I both spore size and shape are relatively constant. If these results are of any value, the range in spore characters among these additional specimens must indicate the occurrence of yet other groups.

Again, among the specimens included in the species *C. coronilla* v. Höhn. & Lit. in the University of Toronto Herbarium are a number with a very distinct appearance and structure. These correspond with the general description of the species but could not be referred to any of the four described groups.

This evidence indicates that *Corticium coronilla* v. Höhn. & Lit., considered in the widest sense is a very complex entity made up of innumerable different and more or less well defined strains.

To consider next the significance of these strains. In a group of simple organisms the characters available for the determination of relationships are necessarily limited. If this fact is taken into account, it will be realized that the four strains of *C. coronilla* described differ from each other in profound and fundamental characters. The occurrence of such differences between related fungi must indicate that they represent distinct species. However, were these groups recognized as distinct, the practical difficulties of species identification would be considerable. Further, it has been shown that this complex comprises many groups other than those described and clearly the creation of new names for these four alone would be of little value. Finally, none of the strains described corresponds at all closely with any of the previously recognized species. The species *Grandinia Brinkmannii* (Bres.) Bourd. & Galz. would appear to be of particularly little value as a Grandinia tendency is present in more than one of the groups described.

It is therefore proposed, for the present, to include all the variations within the species *Corticium coronilla* v. Höhn. & Lit., recognizing that this is a complex entity.

From this study it is evident that when specimens referred to a single species show a wide range of morphological variation one may suspect that this species is a collective entity. These aggregate species are convenient provisional groups made up of innumerable more or less constant genetic strains. Such collective species can have no fundamental systematic importance. It should therefore be realized that without a careful cultural analysis, it is never permissible to regard wide morphological variations within a species as the expression of chance environmental fluctuations.

SUMMARY

Specific limits in the Thelephoraceae are not always clear and the characterization of the simpler species is often inexact. Published descriptions are frequently inadequate and many of the distinguishing features stressed are found to be inconstant. On account of this confusion it was thought that cultural studies in this group might provide additional criteria for the delimitation of the simpler species.

Sets of monosporous cultures were obtained from a range of specimens included in the variable species *Corticium coronilla* v. Höhn. & Lits. Among these cultures four totally distinct cultural groups could be recognized. These groups differed from each other in general growth, presence or absence of asexual reproductive structures, ability to produce basidia in culture and type of heterothallism. The specimens associated with each of the four groups were uniform and minute consistent morphological differences occurred between the members of the different groups. The fundamental differences between these groups can only indicate that they represent distinct species.

A study of additional specimens and cultures indicated that a further study would disclose many other groups in addition to the four described. In view of the very complex nature of the species it was considered best to include all the four types in the collective species *Corticium coronilla* v. Höhn. & Lit. It should, however, be realised that this is genetically a very complex entity.

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THE PERITHECIAL CAVITY FORMATION IN A LEPTOSPHAERIA ON OPUNTIA

B. O. Dodge

(with 2 figures)

The formation of the gill cavities in mushrooms has been the subject of much study and dispute during the last fifty years and there is still disagreement as to the initial processes in cavity formation. On the other hand very few studies have been made in following through the processes by which the central cavities in pycnidia and ascocarps have been developed. Cavity formation in three different types of pycnidia has been described by the writer (**1923**). In *Phyllostictina carpogena* the cavity is largely lysigenetic; in that of *Sclerotiopsis concava* (pycnidial stage of *Pezizella Lythri*) it is about equally lysigenetic and schizogenetic, while the cavity in both the pycnidium and the ascocarp of *Schizoparme* is largely schizogenetic, and the two fruiting structures are also very much alike morphologically. Other literature on cavity formation is cited in the paper referred to.

One does not usually expect to find old herbarium material to be of much value for studies of this sort, but a specimen of *Hendersonia Opuntiae* collected by Wolf (**1912**) and deposited in the herbarium of The New York Botanical Garden proves to be rather an exception in this respect. Wolf has described, the "Sun scald disease," caused by this species of *Hendersonia*. The reader is referred to his paper for information regarding the morphology of the pycnidial stage as he found it on the prickly pear, *Opuntia Lindheimeri*.

The specimen in our herbarium, however, is interesting in that along with many pycnidia of *Hendersonia*, there are also many ascocarps of a fungus which would ordinarily be classed as a *Leptosphaeria*. It is with the organization of the cavity of these ascocarps that the present paper is mainly concerned. As it is

evidently not *L. sicula* reported on *Opuntia,* it will first be described and given a name for identification purposes.

Leptosphaeria Opuntiae sp. nov.

Ascocarps separate, thickly scattered over the segment, imbedded, ostiolate, with a thickened cap or clypeus of dark colored buffer tissue about 200 μ in diam.; perithecial wall 15–20 μ thick. The cavity as seen in sections of dried material is about 130–170 $\times$ 90 μ, and is in young fruit bodies filled with vertically oriented septate hyphae attached to the wall at the top as well as the bottom of the cavity, probably constituting the first "paraphyses"; asci cylindrical, rather thick-walled 70–90 $\times$ 12–15 μ, 8 spored; spores more commonly uniseriate, occasionally partly biseriate, olivaceous brown, 3-septate, 17–20 $\times$ 5–6.5 μ, end cells somewhat smaller. the second and larger cells sometimes with a longitudinal wall.

Perithiciis c. 150–300 μ diam.; ascis cylindricis, 70–90 $\times$ 12–15 μ octosporis; sporis olivaceo-brunneis 3-septatis, 17–20 $\times$ 5–6.5 μ.

On *Opuntia Lindheimeri* Austin, Texas, associated with *Hendersonia Opuntiae* of Wolf in the herbarium of The New York Botanical Garden.

Brefeld (Unters. **10**: pl. 8, fig. 1) figures an ascus of what he calls *Pleomassaria rhodostoma.* Here the second cell in some of the ascospores has a longitudinal wall. Berlese shows an ascus of *Pleospora leptosphaerioides* with the same type of ascospores. In whatever genus we may place this *Opuntia* fungus we are certain someone will soon place it in another genus and make a new combination. In this group of fungi not only are generic distinctions a matter of opinion, but specific differences are often not very distinctive. The particular genus or species of host attacked may be considered of sufficient importance to be diagnostic. Dr. C. L. Shear has suggested to me that this ascocarp has the structure such as von Höhnel made the basis for his group Pseudosphaeriaceae to which *Botryosphaeria* and *Pleospora* belong.

According to Wolf the vegetative mycelium of *Hendersonia Opuntiae* is entirely within the epidermal tissue system. As a result of the presence of the fungus nearby, a suberized callus is formed below. The parasite is therefore not deep-seated. He says that the pycnidia are either above the crystal-bearing hypo-

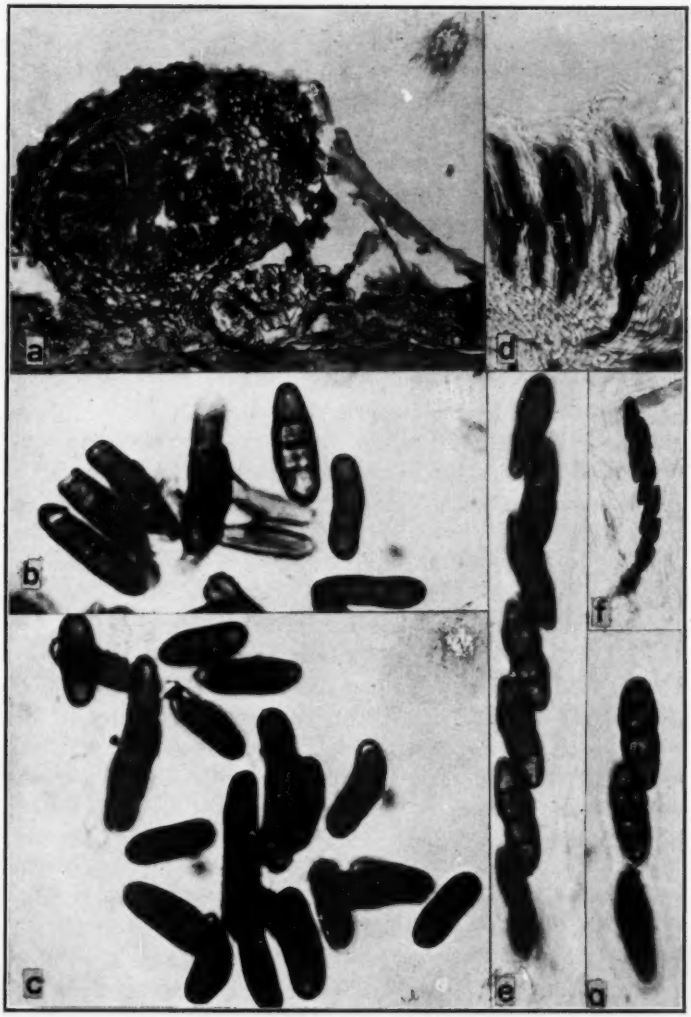

FIG. 1. *Hendersonia* and *Leptosphaeria*.

dermal layer or are developed beneath it. Sections of Wolf's specimen (FIG. 1, *a*) in our own herbarium prove that his statements in this regard are correct, as are also his descriptions of

the wall and thickening around the ostiole. It is difficult to reconcile his description and illustrations of conidia (FIG. 7) with the conidia found in his material, where they are not deeply constricted at the septa and they are certainly not often six times as long as they are wide, 24–30 × 4–5 μ, as he says. We measured some of the conidia and found them somewhat shorter, 17–21 × 4.5–5 μ. Our mounts also show that the spores may be slightly curved, as Ellis pointed out. Wolf's conidia as shown in his fig. 7 look much like the ascospores of the *Leptosphaeria* associated with the pycnidia in his specimen.

Wolf's specimen in our herbarium shows a great many black fruiting bodies distributed over both surfaces of the segment. There are numerous typical *Hendersonia* pycnidia, especially on the one side, but scattered among them there are also numerous ascocarps. On the other side of the segment one finds here and there good pycnidia, but more frequently the fruiting bodies of an ascomycete resembling a *Leptosphaeria,* or as some may prefer to call it a *Clypeosphaeria* because of the thickening around the ostiole (FIG. 1, *a*). Wolf does not mention seeing this ascocarpic form.

On the same sheet is a specimen labeled "*Hendersonia Opuntiae* E. & E. On *Opuntia Ficus Indicus,* Alabama (Carson *592*) Herb. Ellis." We were unable to find any pycnidia in the numerous mounts made from this material, but in every mount one could find fragments of asci with brown, 3-septate spores constricted at the septa (FIG. 2, *n*). Some of this material was imbedded and sectioned. The slides all showed ascocarps but no pycnidia. As the specimen is rather fragmentary it was not considered advisable to search further for pycnidia. Ellis must have seen true *Hendersonia* pycnidia, judging from his description. Whether or not this specimen constitutes the type of the species is not known for certain, but Wolf (**1912**) did see what was claimed to be the type, and says that the pycnidial characters of his material agreed with those of the type. The fact that there is an abundance of ascocarps in the Ellis material as well as in the Wolf specimen, collected far apart, should lead one to consider the possibility of a connection between the *Leptosphaeria* and the *Hendersonia* spore forms.

There are a great many cases where the conidia of an ascomycete resemble very greatly the ascospores of the species, and there are also other species where the pycnidial fruit body resembles the ascocarpic fruit body in its organization. The Wolf material is so abundant that one can study the ascocarps in great detail. They are perhaps more deeply imbedded than the pycnidia, but one cannot tell them apart with certainty until they are crushed in his mounts.

As stated in the description the asci are about 13–15 × 85–90 μ and have rather persistent walls. The ascospores are either uniseriate or partly biseriate. The spores are brown, 3-septate and constricted at the septa, tapering somewhat. The second cell which is usually somewhat larger than the others is rarely divided by a longitudinal wall. Some would insist that this character would take the species out of the genus *Leptosphaeria.* It is certainly not a *Sporormia,* although in the organization of the cavity of the ascocarp it is like "*S. leporina*" described by Arnold (**1928**). Paraphyses (?) are numerous and threadlike. The Ellis material corresponds to the ascocarpic form on the Wolf specimen. The ascospores sometimes show a layer of what may be a very thin transparent substance surrounding them, provided one cuts down the light a great deal. No mucous sheath, such as one expects to see in a *Sporormia,* is present. Berlese shows a layer of transparent substance surrounding ascospores of certain species of *Leptosphaeria.*

One could follow the development of the perithecial cavity very well in this dried material. As the ascocarps begin to enlarge certain cells at the center elongate side by side and divide as the outer layers of the fruit body increase in circumference. The central cells elongate more and more, maintaining their attachment to the inner wall cells above and below (FIG. 2, *h, i*). Finally there appears to be some disintegration of the streamer-like vertical hyphae and some of them disappear as the young ascogenous hyphae begin to grow. The threads that persist and that may be seen in crushed mounts would naturally be referred to as paraphyses. One might be misled by the appearance of the disorganizing threads (FIG. 2, *i*) into thinking that septate conidia are arising in chains and that the young fruit body is really a pyc-

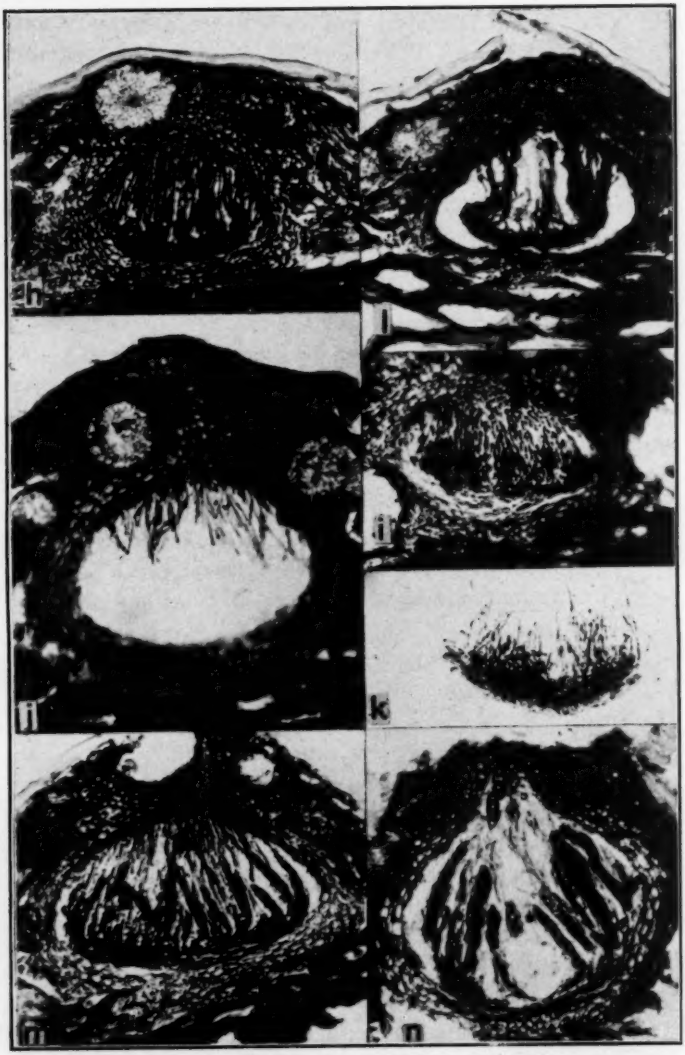

FIG. 2. *Leptosphaeria.*

nidium instead of an ascocarp. We have not seen any young pycnidia in this material so that we cannot say how a *Hendersonia* cavity is formed. But there is no doubt that the young fruiting bodies that we see are young ascocarps, as many intermediary stages have been found.

Arnold (**1928**) has described the origin of the perithecial cavity in "*Sporormia leporina.*" His figures 15–21 represent very well what our sections of the cactus fungus give us (FIG. 2, *h, i*). He says, however: "When the larger perithecia are dissected with needles under a dissecting microscope it is possible to remove the mass of large cells from the cavity still attached to the lower ends of the vertical hyphae which in turn tend to break loose from the top of the cavity with frayed ends. . . . No true paraphyses were observed."

In our material one can prove that the vertically oriented hyphae are attached to the inner wall cells *below* as well as above. They are in a sense intercalary elements which increase in length with the increase in periphery of the ascocarp. These threads undergo a certain amount of disorganization as the cavity enlarges.

It would be strange to find ascogenous hyphae and asci swinging from the lower ends of down growing hyphae in a cavity where they would hang like a swinging basket. There is no question that the ascogenous hyphae and asci are firmly attached to the wall of fertile tissue below (FIG. 2, *j*). The ascogenous elements arise from the layer of active tissue below, so that young asci crowd up between the vertical space-making hyphae. Clements and Shear (**1931**) use the term paraphysoids for plates of cellular tissue between asci, which are more or less like paraphyses. Crushed mounts which include mature asci with spores, show what look to be true paraphyses in our material (FIG. 1, *d*), but some of these threads no doubt represent the original intercalary space-making elements.

Emmons and Dodge (**1931**) show that in species of *Microascus* the ascogonium from which ascogenous hyphae are developing is high up in the ascocarp, just beneath the ostiole which is beginning to form. Space-making hyphae have already arisen from the walls of the perithecial cavity, and as this increases in size, the threads grow mostly upward and inward, although some of them grow

down from above. If these paraphysis-like hyphae are ever originally intercalary, the ends attached to opposite walls, the connection above must break rather early.

The perithecial cavity of *Neurospora* (Shear & Dodge **1927**, pl. 2, *E*) is filled with upward and inward growing hyphal elements, "paraphysoids." These are most clearly visible about the time asci begin to grow up from below, but they soon disappear, providing in their disorganization nourishment for the forthcoming asci. Their primary function is space making, however. In such forms paraphyses or paraphysoids and ascogenous cells may develop from similar elements. Sexuality in such forms may well be confined to nuclear fusion in the young asci. In certain ascomycetes such as *Ascobolus* and *Pyronema*, ascocarps have their origin in special primordia from certain cells of which ascogenous elements grow out, while paraphyses and other sterile tissues develop from basal cells or adjacent hyphal branches.

SUMMARY

A species of *Leptosphaeria* here described as *L. Opuntiae* is associated with *Hendersonia Opuntiae* Ellis & Ev. on segments of *O. Lindheimeri* from Texas collected by Wolf and deposited in The New York Botanical Garden. A specimen labeled "*Hendersonia Opuntiae* E. & E." from Alabama in the Ellis Herbarium also shows numbers of ascocarps of the same *Leptosphaeria*. The ascocarpic and pycnidial fruit bodies develop clypeate buffer tissue about the ostiolar region. Ascospores and conidia are brown and 3-septate. The association and similarities in morphology suggest that possibly these two forms belong to the same fungus. The connection would have to be proved by culture work.

The perithecial cavity develops largely through the differential growth of the peripheral tissues as a wall while the cells at the center elongate vertically by adding intercalary cells so that one sees streamers of hyphae extending across the cavity and attached to the wall cells above and below. Ascogenous elements arise from the fertile tissue at the base and grow up between the disorganizing vertically growing space-making hyphae. These ascogenous elements do not arise from the lower ends of free swinging vertically

downward growing hyphae as claimed for *Sporormia leporina* by Arnold. Otherwise cavity formation in this *Leptosphaeria* and the *Sporormia* seems to be identical.

The writer is indebted to Mr. Frank Paladino for the preparation of slides from herbarium material for this study.

THE NEW YORK BOTANICAL GARDEN

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EXPLANATION OF FIGURES

Fig. 1, *a.* Section of pycnidium of *Hendersonia Opuntiae* Ellis & Ev from the Wolf specimen in the herbarium of The New York Botanical Garden. *b, c.* Conidia of the *Hendersonia* showing three septa and rounded ends; some of the conidia are slightly curved as noted by Ellis. *d.* Asci from crushed mount of *Leptosphaeria Opuntiae* showing asci with "paraphyses" or space-making hyphae. *e.* Spores from an ascus of *Leptosphaeria* more highly magnified, the same magnification as the conidia shown in *b, c.* *f.* Another ascus less highly magnified. *g.* Three ascospores each showing a longitudinal wall in the second cell.

Fig. 2, *h, i.* Sections of young ascocarps of *Leptosphaeria Opuntiae* showing vertically oriented space-making hyphae, which in *i* have begun to disorganize. *j, k.* Section of an ascocarp showing particularly that the space-making hyphae are attached at their upper ends to the inner cells of the perithecial wall. Three large calcium oxalate crystals which develop in the hypodermal layer are visible. The lower ends of these internal hyphae with their attachments to the cells of the bottom of the cavity are shown in fig. *k,* which is a fragment of the section shown in *j,* dislodged by rough treatment so that one can see that these vertical hyphae are also attached to the cells at the bottom of the cavity. *l.* Section of a young ascocarp showing how, because of the shrinkage due to the original drying out process or to

the treatment applied as this dried specimen was imbedded, several layers of cells from the wall of the perithecium have become torn away. The attachments of the vertical hyphae at the top as well as at the bottom of the cavity persist. The ostiole is just beginning to form through lysigenetic processes. Naturally the vertical hyphae attached to this ostiolar tissue would disappear early as shown in the figure, but the layers of fertile tissue at the bottom are not at all affected. *m*. Section of an ascocarp showing rather young asci which are pushing up between the vertically oriented hyphae. These hyphae when seen in crushed mounts would certainly be referred to as paraphyses. Old perithecia might not show such hyphae. *n*. Section of an ascocarp from the Ellis specimen No. 592 labeled "*Hendersonia Opuntiae* E. & E." referred to in the text.

NOTES ON THE SYNONYMY OF FRENCH AND AMERICAN AGARICS—I

MARCEL JOSSERAND AND ALEXANDER H. SMITH

It is generally admitted that confused synonymy is the plague of contemporary Mycology, and chiefly responsible for the babelian state of this branch of natural history: each one speaks a language different from that of his neighbor.

In his inaugural address at the 1934 session of the Société Mycologique de France, Dr. R. Maire remarked that no work was more pressing than the unification of local nomenclature. The first phase of this work, the unification within a country, is already well advanced. A second phase comprises the establishment of equivalences between neighboring countries. This has been started in Europe, notably between France and Switzerland, England, Belgium, etc. Concerning European and American synonyms, continued Dr. Maire, we face a much more delicate problem for one encounters the existence of *geographic races* which complicate the establishment of synonyms between the fungi of the old world and the new.

Lange (**9**) in his comments on agarics in North America discussed briefly the existence of "parallel species" in North America and Europe. He also reemphasized the view which many American mycologists have long held, that, in reality, the North American fungous flora and that of Europe are characterized by the presence of a larger number of species in common than the published floras indicate. The task of accurately determining the true synonyms and the recognition of "parallel species" is however a very delicate one, and involves a careful study of the variations of each species not only in each country but in various regions of the same country as well as in the same locality over a period of several seasons. The coexistence of a striking character in a European and an American species does not suffice to justify the identification of the one with the other. In order to pronounce

them synonyms it is necessary to have a perfect superposition of the two series of characters. If there is the slightest doubt, it appears to be wiser not to place them in synonymy for we believe that it is incomparably less serious and less confusing to permit the existence of two names for the same plant than to designate a mixture of two species with a single name.

This is the principle which is guiding us in establishing the following synonyms. Rather than present a long but uncertain list, we have preferred to restrain ourselves to a discussion of ten binomials of which the equivalences have been carefully verified by exchanges of descriptions, comments, photographs, dried specimens and even in one case fresh specimens.

COLLYBIA MYRIADOPHYLLA (Peck) Sacc.: COLLYBIA LILACEA Quélet

In the region of Lyon the senior author has had the good fortune on several occasions to collect a fungus which is very rare in France, *Collybia lilacea* Quél. Apparently it has not been rediscovered in France since it was described sixty years ago, and has remained poorly known partly because of its rarity and partly because Konrad (**7**) and later Konrad and Maublanc (**8**) published under the name "*Collybia lilacea* Quél. forme robuste" a species not at all similar to that of Quélet. The specimens found near Lyon correspond well to the species of Quélet. This was evident not only from the description by Quélet but also from a water color which was copied directly from the original water color of Quélet and sent to the senior author by Mr. M. F. Bataille who possesses many of Quélet's original paintings and who is well acquainted with the species studied by the famous French mycologist.

This *Collybia* (which might be better placed in the genus *Marasmius*) is characterized by exceptionally crowded amethyst colored gills, by minute spores and by an exceptional anatomical structure: large plates of incrusting pigment on the hyphae of the covering of the pileus and stipe as well as on the cheilocystidia.

Among the American Collybias is found *C. myriadophylla* (Peck) Sacc. which also has violet colored, very crowded gills

and very small spores. The senior author suspected the synonymy, but was blocked by several discrepancies between the characters given by the Americans for *C. myriadophylla* and those which were discovered in the *Collybia lilacea* of France. In particular neither Peck (**12**) nor Murrill (**10**) mentioned cystidia. Kauffman (**5**) specifically stated "cystidia none." As *C. lilacea* in France possessed numerous cystidia, verification was necessary. The junior author therefore sent material from his own and from Kauffman's collections to the senior author who was able to ascertain, contrary to the indications of the describers, that the species possessed numerous cheilocystidia identical with those of *C. lilacea* and furnished with the same incrustation. The other micro-characteristics coincided in an equally perfect manner and no doubt remained. It was then possible for the senior author to state (**3**) the identity of the two plants in a note where he gave a detailed description of the species, scarcely rare in the United States but exceptionally rare in France.

Concerning the name, the rule of priority favors that of Peck who published *Agaricus myriadophyllus* in 1873 (**12**) instead of that of Quélet who published *Collybia lilacea* two years later in 1875 (**16**). The latter is therefore a synonym.

OMPHALIA GRACILIS Quélet: MYCENA IMMACULATA (Peck) Sacc.

It is very hard to be sure that the plant that European mycologists today call *Omphalia gracilis* is indeed the fungus described under this name in 1880 by Quélet. In truth, *O. gracilis* was at first a "mixtum compositum" in Quélet's own mind and contained two or three species. However, it is very probable that the true *O. gracilis* corresponds to the conception of Quélet in his later years. In any case this concept of the species has been definitely established by Konrad & Maublanc (**8**) and secondly by the senior author (**1**).

This white *Omphalia* is well defined by its habit of growing near Abies (or *Picea* in North America), by its subcylindric spores and by the absence of long hairs on the pileus: this last character, joined with several others, distinguishes it from *Omphalia angustispora* Josserand (**1**) which also has elongated narrow spores.

In 1935 the junior author (**20**) stated that *Mycena immaculata* was without doubt a synonym of *O. gracilis*. Later we proceeded with a comparison of drawings, photographs, descriptions and an anatomical study of dried specimens which permitted us to confirm the suggested synonymy.

Concerning the priority of the name, Quélet described *O. gracilis* in 1880 whereas Peck did not describe *Agaricus immaculatus* until 1885 (**14**). Thus the latter specific name must be placed in synonymy.

OMPHALIA MARGINELLA (Pers.) Joss. & Maire: OMPHALIA RUGOSODISCA Peck

In 1931 the senior author in collaboration with Dr. R. Maire (**4**) published a study on *Agaricus marginellus* Persoon, a species poorly interpreted by many authors and of which it was expedient to untangle the synonymy. A description and drawings of the French collections accompanied the account of this study. As a result of it, Smith suggested that *Omphalia rugosodisca* Peck was very similar to *O. marginella*. Not only did the ensemble of the general characters coincide, but the same remarkable exudation of a colorless juice was found in both species.

Two slight differences seemed from the first to separate them. *A*, the stipe of *O. rugosodisca* is said to be glabrous. However, this is an error in description, for specimens collected by the junior author (who has studied Peck's type) were densely pruinose like those of *O. marginella* of Europe. *B*, the edge of the gills is always bordered with pale-brown in *O. marginella* whereas in *O. rugosodisca* the gill edges are practically colorless. The microscopic examination of American specimens prepared by Smith and sent to Josserand cleared up this discrepancy. The edges of the gills of *O. marginella* are composed of numerous cheilocystidia. Almost all are filled with a brown pigment in the vacuole; those which are uncolored are very rare. The pigmented cells cause the brown color of the gill edge. In *O. rugosodisca* one finds the same cheilocystidia as numerous as in the French specimens, but the formula is reversed; those which possess a vacuolar pigment are very rare, the greater portion being colorless and consequently

the gill edge is also colorless or nearly so. The discrepancy is therefore not fundamental but purely quantitative.

In addition to the above, the specimens of *O. rugosodisca* have not only the same spores, the same cheilocystidia and the same caulocystidia, but also the same lactifers, and in particular the same unusual covering of the pileus as found in *O. marginella.* This covering of the pileus is unique or at least rare in *Omphalia.* The hyphae which form it are neither appressed nor upright in a hymeniform layer but rather obliquely and irregularly arranged among themselves. It is this disposition as well as the form of the hyphae which give the cap its particular micaceous, pseudo-pruinose aspect. We say " pseudo " because the pruinosity is not made up in reality of any definite hairs. One finds the same hyphal covering in *Naucoria effugiens* and in another *Naucoria* probably undescribed which presents precisely the same aspect.

The distinctive anatomy of *O. marginella* has confirmed the supposition of Smith and established its identity with *O. rugosodisca. O. rugosodisca* should fall into synonymy unless one prefers to use it as a varietal designation for fruit-bodies having non-bordered lamellae. This should then be written to conform with the rules of nomenclature as *Omphalia marginella* (Pers.) Joss. & Maire var. *rugosodisca* (Peck) comb. nov. Both the species and the variety have been found in the United States, Smith (**21**).

PANELLUS MITIS (Pers.) Singer: PANUS BACILLISPORUS Kauffman

Agaricus mitis, long called *Pleurotus mitis,* but which now should be called *Panellus mitis* since the very legitimate division of the heterogeneous genus *Pleurotus* into several distinct genera, is a species very abundant in France, as well as in all of Europe where it grows in dense colonies on branches of dead conifers.

It is recognized by its ivory-white tint becoming slightly russet in the adults, its tenacity, its gelatinous trama, its mild taste and by its narrowly allantoid spores.

The senior author having read the characters given by Kauffman (**6**) for his *Panus bacillisporus* found that they coincided perfectly with those of the European *P. mitis* and was of the impres-

sion that the two species were the same. This suspicion was substantiated by the fact that *P. mitis* seemed to be lacking in the flora of North America. Upon his suggestion, the junior author examined authentic material of *P. bacillisporus*, compared dried specimens of both species, and found them to be identical. He also examined photographs of the European *P. mitis*. Finally to eliminate all doubt, Josserand had the temerity to send Smith living specimens of *P. mitis* collected near Lyon. Sent in a metallic box on their woody substratum, they crossed the ocean without damage and arrived still fresh in Ann Arbor where Smith was able to reaffirm the identity of *P. mitis* and *P. bacillisporus*. This is without doubt the first time that Agarics have been sent in the living state from one side of the Atlantic to the other.

Agaricus mitis being the older name, *Panus bacillisporus* falls into synonymy.

PHOLIOTA ALBOCRENULATA Peck: PHOLIOTA FUSCA Quélet

This species is not rare in the United States but is extremely rare in France and Europe where it has been reported only three times, twice in France and once in the Carpathian Mts.

The senior author has seen material collected in the region of Lyon, and has been able to study it in detail. Its characters correspond exactly with those given by Overholts (**11**) for *P. albocrenulata* Peck and it is under this name that our colleague Pouchet (**15**), who saw it at the same time the senior author saw the lyonnaise specimens, has given a detailed description of it.

Among the characters of the species should be emphasized the viscid caps of a particular brown and ornamented with appressed scales, the tenacious and elastic cuticle, the large fusoid almond shaped spores with a thick but smooth membrane, and finally the abundant cheilocystidia which form an enlargement of the gill edge, and which macroscopically cause the broad white gill margins which give the fungus its name.

After studying the specimens from Lyon, the senior author suspected that this fungus was *P. fusca* Quélet, a very rare French species not authentically reported since its description. However, the diagnosis of Quélet is too brief to allow one to decide this

question with certainty. Fortunately Mr. M. F. Bataille, a student of Quélet's and possessor of many of Quélet's documents, presented Josserand with a copy of a painting which was executed directly and very carefully from the water color painted by Quélet himself illustrating his *P. fusca*. This water color represents perfectly the aspect of *P. albocrenulata* collected at Lyon and enabled the senior author to publish a note (**2**) stating that *Pholiota fusca* is synonymous with *Pholiota albocrenulata* Peck. Harper had already suggested this relationship.

Concerning the priority of the name, it is apparent that that of Peck was published in 1873 whereas Quélet did not describe *P. fusca* until three years later in 1876 (**17**).

SUMMARY

After exchanging descriptions, photographs, dried specimens and in one case fresh specimens, the writers propose the following synonyms.

1. *Collybia myriadophylla* (Peck) Sacc. (= *Collybia lilacea* Quélet)
2. *Omphalia gracilis* Quélet (= *Mycena immaculata* (Peck) Sacc.)
3. *Omphalia marginella* (Pers.) Joss. & Maire (= *Omphalia rugosodisca* Peck)

If one prefers to conserve a name by which to designate the American form with nonbordered gill edges, the combination *O. marginella* (Pers.) Joss. & Maire var. *rugosodisca* (Peck) Smith & Joss. should be used.

4. *Panellus mitis* (Pers.) Singer (= *Panus bacillisporus* Kauff.)
5. *Pholiota albocrenulata* Peck (= *Pholiota fusca* Quélet)

LYON—ANN ARBOR

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CORYNEUM MICROSTICTUM ON ROSE FROM OREGON

ANNA E. JENKINS

(WITH 2 FIGURES)

INTRODUCTION

In reporting the occurrence in the United States of *Cryptosporium minimum* Laubert, which causes a canker of roses (*Rosa*), it was mentioned (**4**) that on the diseased canes from Oregon [1] were cankers caused by *Coryneum microstictum* Berk. & Br. Only the *Coryneum* canker had been present on diseased tea roses received from the same source a few weeks earlier. It appeared that the fungus had not previously been recorded from Oregon, and it was considered desirable to compare it with the species from elsewhere. An isolation was made, and early in 1934, the fungus was compared with *C. microstictum* from the eastern part of the United States, Canada, and England. Isolations of *C. microstictum* var. *Mali* Kidd and *C. Beyerinckii* Oud. were included in the cultural comparisons.

HISTORICAL

The most extensive discussion of *Coryneum microstictum* on rose appears to be that by Beauverie (**1**) in 1912, in connection with his diagnosis of a rose canker as due to this fungus. At that time he commented upon the paucity of the literature on this subject, and except for occasional records of the fungus in one country or another little has since been published concerning it. *Coryneum microstictum* is not indicated as occurring on rose leaves. There are several such records, however, under other species of the genus, and, in one case, under the variety of *C. microstictum*, wherein the spore measurements are not unlike those given for this species.

In the United States (Alabama), *C. microstictum* was reported

[1] Received from J. R. Kienholz, June 12, 1933.

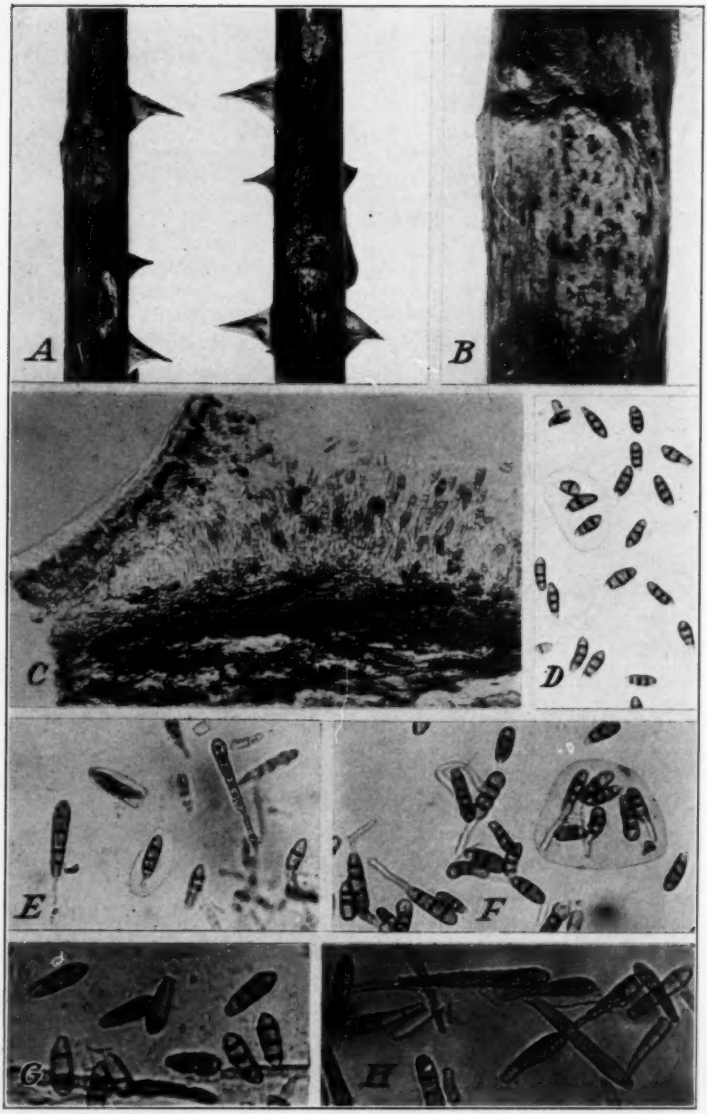

FIG. 1.

on rose as early as 1874 (**2**), but even yet the reports in this country of *Coryneum* on rose are few (**5**).

MEASUREMENTS OF CONIDIA

Conidia from the Oregon cankers (FIG. 1, A, B) measured from 12–23 $\mu \times$ 5–7 μ (FIG. 1, C, D); those from cankers from the eastern part of the United States, referred to in the following section, measured 13.5–21 $\times$ 6–9 μ. Those from cankers collected in Canada [2] and England [2] measured 10.8–15.5 $\mu \times 4.6 \times 6.2 \mu$. The size of the conidia, omitted in the original description (**3**), are given by Saccardo as 15–17 $\mu \times$ 5–6.5 μ (**8**) and also as 16–18 $\mu \times$ 6–7 μ (**7**). Beauverie (**1**) found the conidia he studied to measure 12–15 $\mu \times$ 5–6 μ.

ISOLATIONS AND GROSS CULTURAL COMPARISONS

The isolation of *Coryneum microstictum* from Oregon was made on June 16, 1933, from a specimen received on June 12. The culture from the eastern part of the United States was a reisolation by Cynthia Westcott from artificially inoculated greenhouse roses at the New Jersey Agricultural Experiment Station at New Brunswick. The fungus was recovered by means of spore dilution platings. The original isolation by Doctor Westcott was from large galls at the base of a climbing rose growing at Cornell University, Ithaca, N. Y.

A culture of *C. microstictum* var. *Mali* from apple (*Malus sylvestris* Mill.), originally from Kidd, and a culture of *C. Beyerinckii* from peach, *Prunus Persica* Benth. & Hook.), originally from Beijerinck, were obtained from the Centraalbureau voor Schimmelcultures, Baarn, Netherlands, in March, 1934. Another culture of *C. Beyerinckii* was a recent isolation by Kienholz from the Rochester variety of peach at Hood River, Oregon. In comparing the culture of *C. microstictum* from Oregon with that from the eastern United States, the three other cultures of *Coryneum* were also included as already indicated.

[2] Canada, Victoria Park, Niagara Falls, July 2, 1929, Cynthia Westcott. England, Grosmont (on wild rose) Sept. 17, 1930, Anna E. Jenkins. England, Royal Botanic Garden, Kew, Sept. 29, 1930, Anna E. Jenkins.

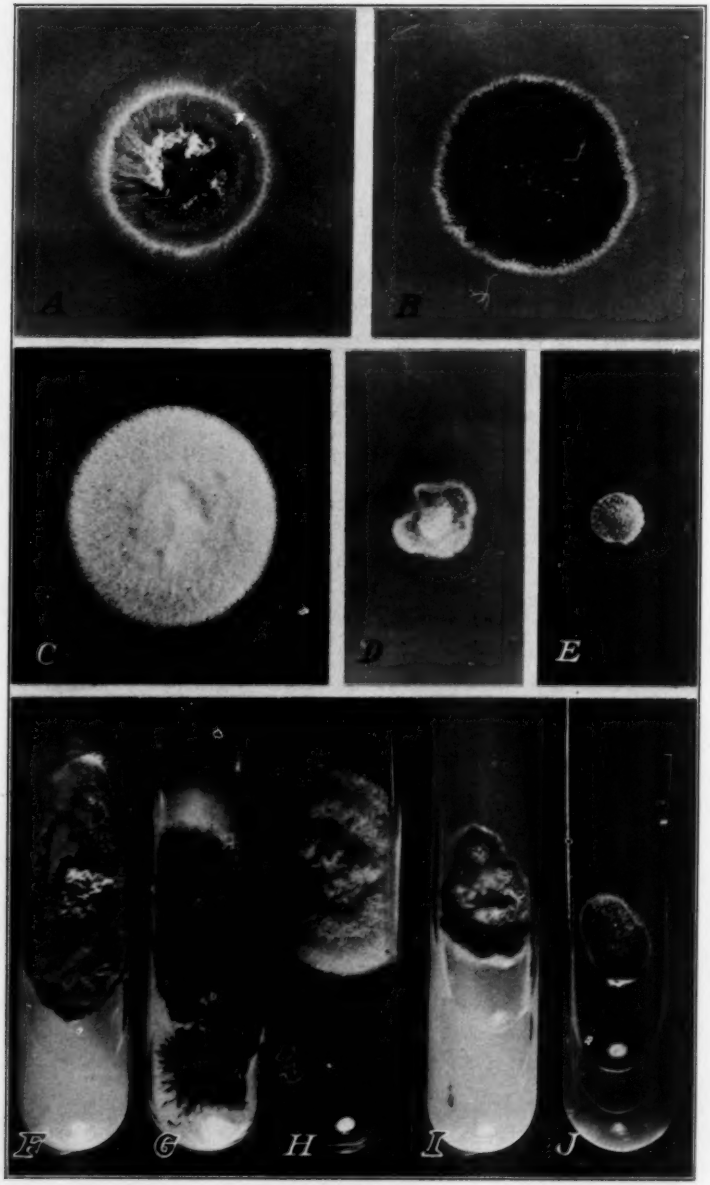

FIG. 2.

On potato-dextrose agar (Thaxter) in Petri dishes (FIG. 2, A–E) the cultures of *C. microstictum* and the variety *Mali* formed a similar group clearly separated from the two cultures of *C. Beyerinckii* by their more effuse growth as compared with the noticeably restricted growth of the latter. These cultures of *C. microstictum* and *C. Beyerinckii* from Oregon were photographed after 5 days' growth, and the other two after 8 days' growth. Color readings were made when the cultures were 4 days old. *Coryneum microstictum* from Oregon was then mostly "tawny olive,"[3] the culture from rose was midway between "mummy brown" and "black," and the variety *Mali* was entirely white. The culture of *C. Beyerinckii* from Oregon was tan or buff; the other culture of this species was "light brownish olive." The marked color differences among the two cultures from rose and the culture of the variety *Mali* were chiefly or entirely due to the pale color of the conidia in the culture of *C. microstictum* from Oregon, as compared with the deeper color of the conidia of the other culture from rose, and the absence of conidia in the culture of the variety *Mali*.

The same general growth characters noted in the Petri-dish cultures were exhibited in test-tube slant cultures as shown here after 9 days' growth (FIG. 2, F–J). The potato-dextrose agar medium used for the slant cultures was made from a commercial powder (Difco). In a subsequent comparison on test-tube slants of potato-dextrose (Thaxter) agar, conidial formation was not apparent in two 3 weeks old cultures of *C. microstictum*. The cottony growth of the culture from Oregon was warm white faintly tinged with pink and of the other culture from rose was white faintly tinged with yellowish gray. In the same comparison vegetative growth at the central part of the Oregon culture of *C. Beyerinckii* was "pale grayish vinaceous" and the marginal growth "light brownish drab"; the central part of the culture from Europe was "pale drab gray," and the marginal part nearest to "tilleul buff." A week later the same cultures of the two species were less distinctive in their color differences.

[3] Color readings in quotation marks are based on Ridgway (**6**).

COMPARISON OF CONIDIA FROM CULTURES

An examination of the Petri-dish cultures when they were 5 days old, showed most of the conidia from the culture of *C. microstictum* from Oregon to be lighter colored than those direct from the canker from which the isolation was made, and also lighter than those from the other culture from rose. Many of the conidia were also larger, and often much longer, with as many as seven cells. In a much older culture examined the conidia were definitely colored as in the other culture of *C. microstictum* (FIG. 1, E, F).

Although conidia from the two cultures of *C. microstictum* from different sources were similar, those from the two cultures of *C. Beyerinckii* were distinct. In the culture from Oregon they were short and few-celled; in the culture from Europe, they were much longer with as many as seven cells. No further study of these two strains was made, although it was noted that Smith (**9**) in California had observed conidia of the first type on peach bark and of the second in agar cultures.

SUMMARY

On specimens of *Coryneum microstictum* on cankered rose canes from Oregon the conidia measured essentially the same as those on rose from the eastern part of the United States; those from Canada and England were somewhat smaller. Composite measurements of conidia from all these sources (10.8–23 $\mu \times$ 4.6–9 μ) accord well with those previously published by others for this species on rose, which are also variable.

Culturally the fungus from Oregon resembled that from eastern United States, although it was separable in color. It was also similar to an authentic culture of *C. microstictum* var. *Mali*. These three cultures produced a noticeably less restricted growth than two cultures of *C. Beyerinckii* from different sources (Oregon and Europe) included in the same comparison, and also shown to be separable from each other.

In culture conidia of *C. microstictum* from Oregon were often larger than those direct from the cankers, and some were much longer with as many as seven cells. They were similar to the

conidia from the other culture of this species from eastern United States.

Conidia of the two cultures of *C. Beyerinckii* differed from each other. In the one from Oregon they were few-celled and relatively shorter, whereas in the one from Europe they were usually longer and sometimes contained as many as seven cells.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

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EXPLANATION OF FIGURES

Fig. 1, A–F. *Coryneum microstictum.* A. On rose canes from Hood River, Oregon, J. R. Kienholz, May, 1933 (× 1). B. Enlargement of cane at right in A showing conidial pustules. C. Part of a pustule (× 200). D. Conidia from pustule (× 350). E. Conidia from old culture of *C. microstictum* from Oregon (× 325) and F, from a young culture of the fungus from Eastern United States (× 350). G. Conidia of *C. Beyerinckii* from culture 5 days old from Oregon and H, from Europe (× 350).

Fig. 2. Potato-dextrose agar Petri-dish cultures of *C. microstictum* from (A) Oregon and (B) Eastern United States, and (C) of the variety *Mali;* also of *C. Beyerinckii* from (D) Oregon and (E) Europe. F–J. Same cultures in the order named, after 9 days' growth on test tube slants of potato dextrose agar (Difco). (All × 1.)

NOTES AND BRIEF ARTICLES

Dr. C. L. Shear, recently retired as principal pathologist in the United States Department of Agriculture, is continuing his work in mycology as a collaborator in the Division of Mycology and Disease Survey. He is devoting his attention chiefly to systematic studies of the Xylariaceae and has just spent a few weeks at The New York Botanical Garden examining the collections of this group of fungi. Dr. Shear has donated his herbarium of flowering plants to the Rocky Mountain Herbarium at the University of Wyoming. His large collection of fungi has been given to the mycological collections of the Bureau of Plant Industry. His library containing many mycological, pathological, general botanical, and miscellaneous scientific works is being offered for sale. A catalogue can be obtained by addressing him at No. 1219 North Oak St., Arlington, Virginia.

CORRECTED NOTICE

The headquarters of the Mycological Society of America have been changed from the Washington Hotel to the Warren Hotel, Illinois St., less than two blocks north of the Union Station, and approximately the same distance south of the Claypool and Lincoln which have been designated jointly as general headquarters for the A. A. A. S., the former also the headquarters for the greater number of botanical societies. The rates for rooms with baths are $2.25–3.50 for a single room, $3.50–5.00 for a double room.

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